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Miners Making the Electrical Connections for Blasting a Monster Block of Carrara Marble.

THE MARBLE QUARRIES OF CARRARA.—[See page 361.]

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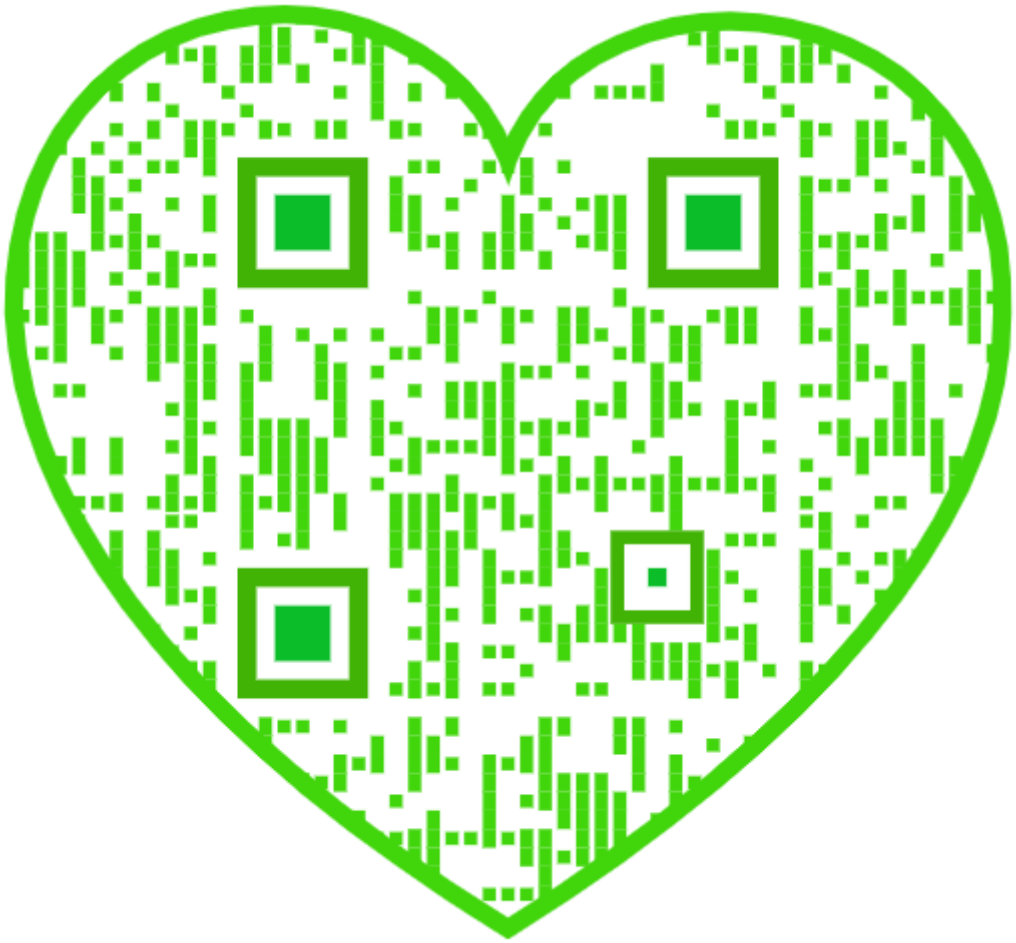

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NEW YORK, SATURDAY, NOVEMBER 16, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE MAN BEFORE THE FURNACE.

In the struggle to advance the records for transatlantic steaming which is now attracting so much public interest, the final decision of the question as to what figure that record shall reach depends upon the man before the furnace. It is a matter for the fireman to determine. This fact has long been understood by the big steamship companies; and when a new flier is about to make her one supreme attempt to accomplish a record passage, picked men in the fireroom and special bonuses contribute not a little to the record-breaking effort. The importance of the fireman is clearly evident in the case of the two quadruple-turbine steamers, which are now being placed in service. On her trial trip of 1,200 miles the "Lusitania" made 26.45 knots for 300 miles, and 25.40 knots for 1,200 miles. On that occasion, it goes without saying that good coal and selected firemen insured that in every one of the twenty-five boilers steam was maintained steadily at the standard pressure of 200 pounds to the square inch. Given an ample supply of steam at that pressure, and fairly good weather, and the "Lusitania" stands good to make at any time her 25 to 25½ knots over the whole transatlantic course. But let any such conditions as poor coal and inefficient firemen be introduced, and the steam pressure and speed will drop accordingly. So far the "Lusitania" has made 24.25 knots for the whole passage, and her average is advancing with each voyage; but if a comparison were made between the log of the navigating officer and the log of the engine room, it would be found that there was a remarkably close correspondence between the curve of speed and the curve of steam pressure.

Within another week the "Mauretania" will start on her maiden voyage. Because of the fact that on her trial trip she has proved to be from two-thirds of a knot to a knot faster than her predecessor, even greater interest will attach to the performance of this ship. In a single run over the 300-mile course through the Irish Sea she averaged 27.36 knots, which is equal to about 31½ land miles an hour. On the whole 1,200-mile course her average was 26.03 knots. If the ship has maintained 26 knots for 1,200 miles, there is no reason why, under equally favorable weather conditions, she should not maintain that speed from Queenstown to Sandy Hook. In her case, as in the case of the other ship, it will be a question of the ability of the firemen to maintain the steam pressure at the standard set by the designers.

THE PRESENT STATUS OF TRANSATLANTIC WIRELESS TELEGRAPHY.

The recent announcement that wireless telegraph communication had been established on a commercial basis between Glace Bay, Nova Scotia, and Clifden, Ireland, has been followed by the usual storm of controversy between the man who takes everything on faith and the man who will not accept a fact that he does not observe with his own eyes. The SCIENTIFIC AMERICAN believes that the highest praise is due to Signor Marconi for his pioneer work and for the perseverance which has carried him to his present success, and this without depreciating the work of others in the same field. However, we realize that many exaggerations have been printed which probably will do harm unless corrected. Several years ago it was announced that the Marconi Company was ready to deliver commercial messages across the Atlantic, but a breakdown occurred and communication was suspended. In view of this failure, it is but natural for certain persons to be somewhat skeptical as to the actual commercial status of the present system. Some have even gone so far as to hint that no messages whatever were transmitted across the Atlantic, but that false reports were given out with a view to booming stocks. With such suspicions we have no sympathy. No opportunity has been afforded us of actually testing the transatlantic transmission of messages; but those who desire positive evidence will find ample proof in the reports of independent stations not interested in the success of the Marconi Company.

In the current SUPPLEMENT we publish a letter from Prof. Reginald A. Fessenden, who describes the work at Glace Bay as recorded by the messages received at his own station at Brant Rock, Mass. Wireless telegraphy is not a secret means of communication, and the various selective systems, about which one hears so much, operate not to prevent outsiders from receiving one's message, but to prevent outsiders from interfering with the receipt of the message. Thus, while Marconi could adjust his instruments to prevent other stations from seriously affecting the receipt of his messages from Clifden, he could not prevent those same stations from receiving both the Glace Bay and the Clifden messages. As no secret code was used, Prof. Fessenden was able to keep a complete record of the Marconigrams, although Brant Rock is over 600 miles from Glace Bay. On October 18, when the system was officially opened, 1,400 words were transmitted across the Atlantic, after which it was necessary to suspend operations due to atmospheric disturbances. The actual rate at which the messages were sent was seven words per minute; but as a great many messages had to be repeated, the effective rate was reduced to three words per minute.

The wave length used at Glace Bay differed from that used at Clifden and, according to Prof. Fessenden, was "broader than is advisable for cutting out interference and atmospheric disturbances. . . . A cable can operate to within a half hour of the arrival of a lightning storm, and some of the well-known means for achieving this protection should be used for wireless stations. If it is not done, operation becomes impossible in the summer months, as with long-distance stations there is always some thunderstorm within the radius of operation." In the fall atmospheric conditions are the best for the transmission of Hertzian waves; the real test will come during the summer months. Although the Marconi system may not yet have attained a sufficient degree of speed and reliability to meet the exacting demands of commercial service, it has scored the greatest actual advance, so far, in this direction.

THE EIGHTH NATIONAL AUTOMOBILE SHOW IN MADISON SQUARE GARDEN.

The eighth annual automobile show under the auspices of the Association of Licensed Automobile Manufacturers was held last week in Madison Square Garden. In this, the second big show to be held this fall in New York, most of the older makers of automobiles, as well as a few new ones, were represented. Among the latter should be mentioned the inventor under whose patent covering the application of a clutch to a gasoline machine the members of the association are licensed. The new Selden car is of the standard 4-cylinder type, with shaft drive, and without any startling innovations. On the other hand, the company which purchased the Selden patent and subsequently formed the association, has still further improved its car with electric transmission (which it first brought out this year) and for 1908 a powerful 60-horse-power model will be produced. The electric transmission makes the machine as easily controlled as an electric automobile or a trolley car, and does away with transmission troubles such as the stripping of gears and the like. Three of the most interesting of the commercial vehicles in the basement consisted of a power wagon and two trailers, all of which were propelled by electricity produced by a dynamo direct-connected to a 50-horse-power 4-cylinder engine in the forward one. These vehicles all had six wheels, of which the large middle pair were the drivers, they being revolved by electric motors and chains. The wheels were fitted with broad steel tires, and the trucks looked amply able to carry the load of 7 tons claimed as the capacity of the train.

The exhibit of electric vehicles was very complete and showed some improvement in the way of mileage per charge, there being several machines for which a mileage of over 100 was claimed and a maximum speed, for spurts, of over 30 miles an hour. There were several additions to the high-speed, gasoline-type, electric runabout which was first exhibited last January. Many of the makers also showed removable bodies and offered excellent combinations in this line. Some of the electric machines were fitted with a foot-operated controller, and the wheel seems to be replacing the lever for steering.

The gasoline cars exhibited were practically all fitted with engines of the multi-cylinder vertical type. About 25 per cent of them had 6-cylinder engines, while most of the remainder had engines of the 4-cylinder type. A two-cycle car was shown in 3 and 4-cylinder models, while a well-known horizontal single-cylinder machine was shown in a number of different models. The cheapest car at the show was one formerly built as a buckboard, but now remodeled and fitted with a false bonnet. This little runabout now sells for $400. It is fitted with a single-cylinder air-cooled motor and friction disk transmission. The most interesting low-priced runabout on exhibition was fitted with a 4-cylinder motor, shaft drive, and planetary gear transmission. It had a rumble seat and was a perfect copy in miniature of the popular high-powered runabouts.

The two pioneer makers of air-cooled cars, as well as one other concern, exhibited 4-cylinder models, while one of the former also showed a 6-cylinder. Two of these companies now make water-cooled engines as well, however, so that the purchaser can have his choice. One of the first of American makers has pinned his faith to the 6-cylinder engine so completely that his firm will construct no other type. The general tendency, however, is to regard the 6-cylinder engine largely as a fad to which the manufacturer must cater in order not to lose trade. The constant torque and lessened vibration of this type of engine are nevertheless indisputable advantages. A large percentage of all the engines had high-tension magneto ignition in addition to that with accumulators and coils. Two separate sets of spark plugs are generally fitted. Make-and-break ignition was shown on but a few cars. Two or three makers also showed engines with ball-bearing crankshafts. The use of ball or roller bearings in the transmission, rear axle, and wheels is also quite general.

Improvements in the chassis of 1908 cars consist chiefly in longer springs and better brakes. The brake drums are now made larger and wider, giving much more surface and making it possible to stop a car with greater certainty and in a shorter distance in case the emergency arises. As for the bodies, these are more luxurious than ever, some of them being finished with hand-buffed leather, silver-plated door handles, etc. The runabout with rumble seat has been developed, in some cases, into a 4-passenger roadster having two small seats behind; and one enterprising manufacturer showed a tonneau with a chauffeur's seat hung over the running board about on a level with the floor and on the opposite side to the driver's seat, which was placed slightly in advance of the one beside it. Among the limousines a novelty was a stage-coach type of body with a phaeton hood and glass front over and in advance of the driver's seat.

The sole representative of the steam machine was that well-known make with flash boiler, condenser, and compound engine, which had as its chief improvement a thermometer gage on the footboard to show the temperature of the steam.

This exhibit of standard 1908 cars, although showing no radical changes over the cars of the present year, has nevertheless demonstrated a steady advance along rational lines and has shown that the older manufacturers are continually improving their product and bringing it nearer to that perfection which all wish to attain.

M. B. Sziland makes a communication to the Académie des Sciences upon the supposed discovery of a new radio-active salt. A French experimenter, M. Lancien, stated that he had prepared a molybdate of uranyl whose radio-activity was much greater than that of nitrate uranyl. According to him, the activity of the molybdate is comparable to that of a radiferous barium salt of an activity equal to forty times that of metallic uranium. On the other hand, the previous work of scientists has shown that the activity of uranium salts is always in proportion to the amount of uranium which they contain. This is especially brought out by Madame Curie. We are able, by means of certain chemical operations, to deprive temporarily a uranium compound of the greater part of its activity, and to concentrate this in a small residue of the treatment, but this modification is not permanent. After a certain time, the residue has lost its activity and the uranium salt gradually recovers its original activity. Therefore in the state of equilibrium, the salts of uranium have a radio-activity which is less than that of uranium. As the result announced by M. Lancien was in contradiction with this fact, it seemed necessary to confirm it. Accordingly the experimenter prepared the molybdate of uranyl following M. Lancien's process, which consists in precipitating a solution of uranyl nitrate by molybdate of ammonia. He prepared two samples, one of which was obtained in the presence of an excess of uranium salt and the other with an excess of molybdate. Using the specimens in the form of dry powder, he measured their activity during a period of twenty-five days, and found that the value for the two specimens was the same, as might be expected, and was below that of uranyl nitrate. It is represented by the fraction 0.3 of the activity of metallic uranium. By the photographic effect of the compounds the molybdate of uranyl shows the normal value. These results show that contrary to what has been announced, the molybdate of uranyl has no special advantage as concerns the radio-active quality.

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HOW THE PLANETS ARE PHOTOGRAPHED.

BY DR. S. A. MITCHELL, COLUMBIA UNIVERSITY.

The safe arrival in the United States of 7,000 photographs of the planet Mars is an astronomical event of no small importance. To transport a delicate lens 18 inches in diameter from New Hampshire to the Andes, to carry this lens and its mounting up to the height of 14,000 feet above sea level and there assemble the many parts into a perfect running machine, a powerful telescope, is in itself a gigantic undertaking. But when there is added to these almost insurmountable obstacles the difficulties of existing—we can hardly call it living—for a couple of months on an arid desert so high above the sea, we can gain some small insight into the huge task undertaken by Prof. Todd of photographing Mars at its near approach to the earth.

Whether these photographs prove that Mars is inhabited or not, Prof. Todd and his chief assistant, Mr. Slipher, who made all the photographs, are deserving of nothing but the greatest praise for overcoming great observational difficulties and procuring this splendid series of plates made under the greatest of bodily discomforts. One does not ordinarily go and live in a desert for the sake of having a pleasure trip; and the only motive that could have actuated Prof. Todd and Mr. Percival Lowell in financing and sending out the expedition, was the desire to arrive at the truth regarding the interesting markings on the planet Mars.

Those who have never tried to photograph the stars can have no idea of the difficulty of the task; but when one attempts to portray the planets in detail, these obstacles are increased many times. Photography is no new art. We all of us know how easy it is to take a snapshot of a landscape and get a pretty picture; why is it then that no serious attempt has ever been made before to observe the planets with the help of the photographic plate? However, when it is mentioned that a huge camera with a lens 18 inches in aperture and 25 feet in focal length gives an image of Mars, when it is nearest to the earth and consequently at its largest, only 1/25 of an inch or one millimeter in diameter, the size of a pin head, one sees the utter impossibility of showing any details on so small an image, much less to decide whether a given mark is a straight canal or some other geographical feature. A photographic plate placed at the focus of the 18-inch telescope that Prof. Todd used would give a picture but one millimeter (0.039 inch) in diameter. After such a plate was developed, it could of course be enlarged by an ordinary camera, and a bigger Martian picture obtained. For a minute study of planetary detail this method would lead to results of little or no practical importance.

It may be asked, Why not use a telephoto lens on Mars? This has led to splendid results in landscape work, giving a picture of mountains fifteen to twenty miles distant as if they were only a short way off. This is in reality the very process used in photographing Mars or Jupiter. A magnifying lens is placed in the telescope just before the photographic plate, and an enlarged image of the planet is obtained. Prof. Todd has used a magnification of about five diameters in getting his Andes photographs. A greater enlargement than this is practically impossible. The much-heralded photographs of Mars taken with such an expenditure of time, energy, and money (the original photographs cost about a dollar apiece) have the scant diameter of 3/16 of an inch, and the photographic work must be of the very best, and great observational difficulties must be overcome to procure even these tiny pictures.

When the celebrated firm of Alvan Clark & Co. made the Amherst lens, they did not intend it for photography, and accordingly ground and polished the objective so that the yellow and green of the spectrum, the colors that most affect the eye, should be brought to a good focus. A lens can be considered as made up of a series of prisms, and we all have seen how the ordinary prisms on a chandelier break up white light into its spectrum colors. Thus when a star is viewed through a good astronomical telescope, the red and blue rays are not sharply focused, and as a result the star is surrounded by a beautiful purple color. With this color the astronomer is always familiar, but it invariably leads the beginner on his first peep through a big glass to exclaim "What magnificent colors!" If an ordinary photograph were made with a visual lens, it would be impossible to get a sharp image, for the simple reason that the optician in making the lens did not grind it with the purpose of bringing to a good focus the blue and violet light which most affects the photographic plate. This can be done by the optician, and we then have a good photographic telescope, but a poor visual one.

If an astronomer happens to have a first-class visual telescope, and wishes to take photographs, he has to adopt a measure with which we are all familiar in landscape work—that of using a ray filter or color screen and isochromatic plates. This color screen must be used a little more intelligently than is done in landscape work by even the best professional photographers. It becomes necessary to make a careful study of the objective, and construct a color screen of a very particular kind. Mr. Wallace, of the Yerkes Observatory, has done some admirable work in investigating photographic plates and ray filters, and a "Wallace screen" and isochromatic plates have been found to give splendid celestial photographs with visual lenses.

But consider how the light from Mars must travel after it reaches the telescope before an image 3/16 inch in diameter is obtained on the photographic plate; through the objective, through the lenses that make up the magnifier, then through the color screen to an isochromatic plate. All these several parts must be in the best of adjustment and focus, if a good sharp picture is to be obtained. But during the ten or fifteen seconds that are necessary to photograph Mars, its light has had to travel through miles and miles of the earth's atmosphere. This, we know from the twinkling of the stars, is always in a state of unrest. The disturbance in the air blurs the photograph, and it is next to impossible to get a good image, one in which the very fine details will stand out hard and sharp. The only feasible way of overcoming this difficulty is the method adopted by Prof. Todd of making a series of exposures, twenty-five to fifty in number, all on the same plate. When the plate is developed, the few seconds of best seeing will be evident from the increased sharpness of the photographs.

Mars was closer to the earth in 1907 than it has been at any time since 1892; but unfortunately for the observatories of America and Europe, it was very low down in the sky. At the beginning of July, when nearest the earth, Mars at the Yerkes Observatory was never more than 20 deg. above the horizon. This necessitated looking through a great thickness of the earth's atmosphere. It was to diminish the ill effects of this atmosphere that the Lowell expedition went to the top of the Andes.

Prof. Barnard, with his beautiful photographs of the Milky Way and star clusters, has shown more than any other man the wonderful possibilities of photography in astronomical work. With the 40-inch Yerkes telescope, he made splendid photographs of Jupiter. At the focus of this great telescope (over 60 feet in length) Jupiter when nearest the earth appears directly as an image 3/16 inch in diameter. When enlarged five diameters, Jupiter is nearly an inch in diameter, just as if it had been photographed with a telescope 300 feet in length!

But Jupiter is more easily photographed than Mars; first, because in the telescope it is about twice as big as the ruddy planet; and second, because Jupiter's surface being about two and a half times brighter than that of Mars, a shorter exposure is necessary. To get original negatives of the same size from the two planets, it would be necessary to give Mars ten times the exposure of Jupiter!

The astronomical world is awaiting with great eagerness the verdict of Mr. Lowell when he examines carefully the Andes photographs. If nothing definite is proven this year regarding the canals of Mars, there will be another chance to try it again in 1909. Then the planet will be even closer than it was this summer, but what is more important, it will be 25 degrees higher in the sky, and this will permit the Lick and Yerkes telescopes to turn their full power on Mars, and make photographs which with the latter instrument will be as large as one-half inch in diameter.

THE CURRENT SUPPLEMENT.

A report upon an elaborate series of tests of internal combustion engines on alcohol fuel has been prepared for the Department of Agriculture by Charles E. Lucke, Assistant Professor of Mechanical Engineering at Columbia University, and S. M. Woodward, of the office of Experiment Stations. A generous abstract of this report is published in the current SUPPLEMENT, No. 1663. J. H. Morrison's treatise on the development of armored war vessels passes to a twelfth installment. The first American ironclad in service and the old and the new navy are the topics discussed. Samuel R. Bennett describes some improved methods of dust prevention in the grinding trades. Alloyed steels, such as nickel, chromium, vanadium, silicon, tungsten, and the like, are coming into more general use every day, for the parts of high-grade machinery which are subjected to a high rate of wear, which have to support a great weight, or which are subjected to excessive strains, stresses, and vibration. For that reason, E. F. Lake's suggestions on the forging of alloys ought to prove of value and interest. The use of captive war balloons at Casablanca is illustrated and described. The injurious effect of light upon the eye is dilated upon by Dr. A. Birch-Hirschfeld. How fresh-water fish care for the eggs of their young is described by Theodore Gill. Sir George Birdwood writes interestingly on the mechanism of the southwest monsoon. Ethnologists will read with interest W. A. Cook's description of the Bororo Indians of Matto Grosso, Brazil.

SCIENCE NOTES.

The Royal Society of England, with the approval of King Edward, has awarded the Copley Medal to Prof. Albert A. Michelson of the University of Chicago for optical investigation. It has awarded the Davy Medal to Prof. Edward Williams Morley of Cleveland, Ohio, for his investigations in physics and chemistry, and especially for his determination of the relative atomic weights of hydrogen and oxygen.

Dr. J. Schubert, of the Prussian Forestry School at Eberswalde, as the result of five years' study of forest influence on rainfall, says that of seventeen gage stations in the forest, at the forest's edge, and in the open, the forest stations show the greatest, and the open stations the least precipitation. Corrections for snowfall and for difference in the exposure of the gages as regards wind, amount to 5.5 per cent; the observed difference in catch being 5.2 per cent.

San Francisco is suffering from a plague of rats, and is offering a bonus for their destruction. Apart from the general destructiveness of rats, they carry and transmit the bubonic plague, and have often aided in spreading pestilence through Asiatic cities. They are so prolific that any temporary upsetting of the "balance of nature" may result in an enormous increase in their numbers. The earthquake in San Francisco doubtless provided them with innumerable safe hiding places, and in other ways favored their increase.

M. I. St. Murat, director of the Meteorological Institute of Roumania, publishes the results of his study of the retarding influence of forests on wind velocity in the Annales of the Roumanian Academy. He finds that the greatest effect which a forest can have upon the wind consists in diminishing the wind velocity to leeward of the forest. At 164 feet this decrease in velocity may amount to 4 to 7½ miles an hour, which means a reduction of the force of the wind by one degree on the Beaufort scale. This decrease is felt within 330 feet of the forest. After that the velocity increases again with increasing distance, and at about 1,640 feet reaches the force noted before the forest was encountered.

An interesting phenomenon recently discovered by Marckwaldt consists of an alteration occurring in the color of a body under the action of light, while the original coloration is re-established in the dark. The substances showing this phenomenon are very few in number, though, according to communication by Prof. H. Stobbe at the recent Congress of German Naturalists and Physicists, the group of fulgides contains a number of substances of this kind. This phenomenon, called phototrophy, is of especial importance for chemical and physical science, as possibly embodying an immediate conversion of light waves into chemical energy. It might become extremely valuable for photography or for any other art utilizing radiations of a similar nature.

Astronomers are uncertain as to whether comets are coming from spaces beyond the limits of our planetary system or from this system itself. While the latter hypothesis seemed to be more plausible, the fact that a few comets show a hyperbolical trajectory (in opposition to the elliptical or parabolical trajectories of the remainder) could not be made to agree with it. In a paper recently published, Messrs. Fabry and Fayet (see Revue Scientifique, No. 16) show that the departures from the elliptical or parabolical shape of the trajectory observed in the case of a few comets are due to the disturbing effects of the planets of our system, especially of Jupiter, whose influence obviously is paramount. According to this statement, all the comets that have so far appeared are thus permanent astres belonging to our planetary system.

OFFICIAL METEOROLOGICAL SUMMARY, NEW YORK, N. Y., OCTOBER, 1907.

Atmospheric pressure: Highest, 30.60; lowest, 29.47; mean, 30.06. Temperature: Highest, 73; date, 7th; lowest, 36; date, 31st; mean of warmest day, 68; date, 4th; coolest day, 42; date, 21st; mean of maximum for the month, 59.8; mean of minimum, 45.2; absolute mean, 52.5; normal, 55.4; deficiency compared with the mean of 37 years, —2.9. Warmest mean temperature of October, 61, in 1900. Coldest mean, 50, in 1876. Absolute maximum and minimum for this month for 37 years, 88 and 31. Average daily deficiency since January 1, —1.3. Precipitation: 3.82; greatest in 24 hours, 1.96; date 27th and 28th; average of this month for 37 years, 3.70. Excess, +0.12. Accumulated deficiency since January 1, —1.36. Greatest precipitation, 11.55, in 1903; least, 0.58; in 1879. Wind: Prevailing direction, N. W.; total movement, 9,227 miles; average hourly velocity, 12.4 miles; maximum velocity, 50 miles per hour. Weather: Clear days, 18; partly cloudy, 9; cloudy, 4; on which 0.01 inch or more of precipitation occurred, 9. Thunderstorms: 27th, 28th, 29th. Frost: light, 16th 19th, 27th; heavy, 21st, 22d, 25th, 31st.

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EDISON'S SYSTEM OF CONCRETE HOUSES.

The new method of building dwellings of small cost, recently announced by Mr. Thomas A. Edison, opens tremendous additional possibilities for the use of concrete. Instead of the old box-like concrete structures with which we are all familiar, it will be possible to have attractive houses at a much lower cost than was possible in the first-mentioned type.

When asked in what particulars his idea was novel, Mr. Edison said: "There is nothing particularly novel about my plan; it amounts to the same thing as making a very complicated casting in iron, except that the medium is not so fluid. Some one was bound to do it, and I thought that I might as well be the man, that's all."

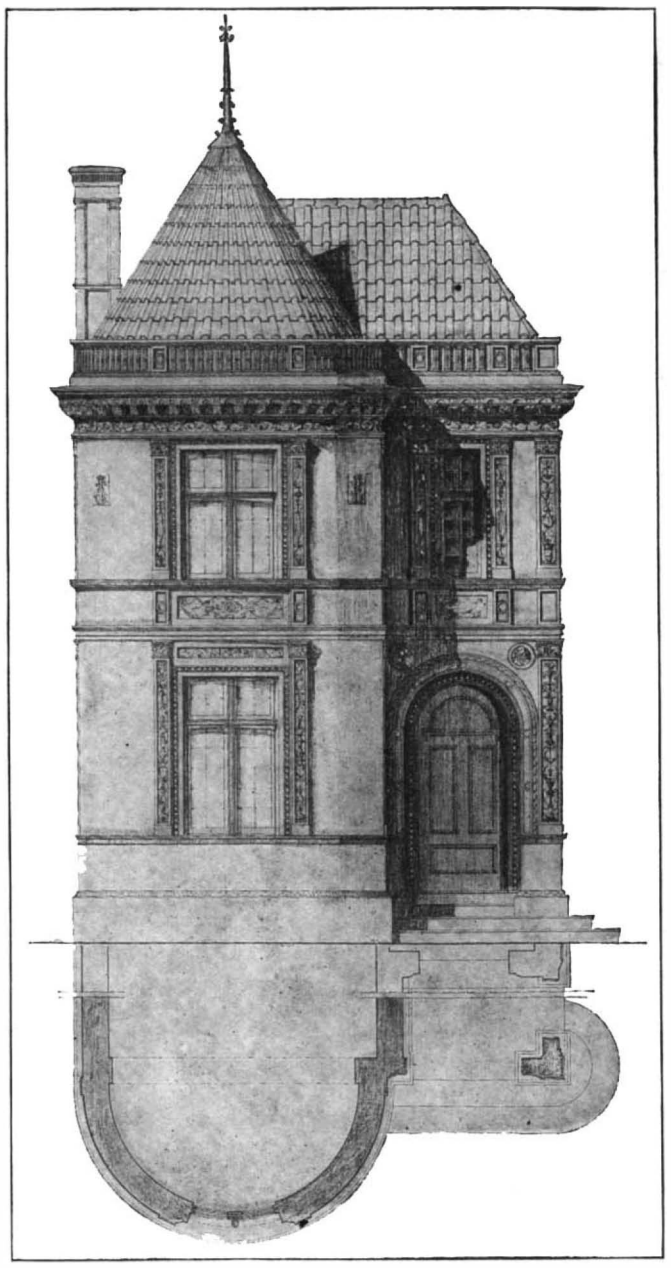
The method consists in the use of molds, costing $25,000 the set, made of ¾-inch cast iron, planed, nickel-plated, and polished. The different pieces vary in size, some of the interior parts being but two feet square. When in position, the units are held in place by trusses and dowel pins. Into the top of these molds concrete is pumped continuously by compressed air, using two cylinders. The concrete itself acts as a piston, and the two cylinders are alternately filled and emptied. The delivery of the mixture must be continuous, for wherever it is stopped a line appears. To secure this rapid and continuous flow, at the rate of 175 cubic yards per day, a very efficient mixer is required. It has not yet been decided whether a Ransome or a specially designed machine will be used. No rubbing up is necessary, although a few flaws may be present, owing to the difficulty of expelling all air. The escape of air is permitted by the special design of the house, or, when necessary, by a temporary pipe, which may be removed later.

The concrete used is mixed according to the ordinary proportions of one part of cement high in lime, three parts of sand, and five parts of crushed stone. The cement is so finely ground that it readily takes up the requisite quantity of water to make it flow. Another result of the fine grinding, to which the possibility of reproducing minute details is due, is the absolute water-tightness of this material, since there are none of the intergranular openings that are present when coarse ingredients are used. Great strength is assured at the points of stress by wire reinforcements set in the body of the material.

Bath-tubs and similar fixtures will be cast in place. Pipes for the steam heat, conduits for the electric wiring, and the iron tubing through which the lead pipes for the plumbing are to be afterward drawn, are all set in the molds before the cement is run in. The only wood present will be the doors, window sashes, and perhaps a few strips to which to attach carpets.

Although any type of architecture can be followed in making the original molds, the first house of this kind to be built will be in the style of Francis I., richly decorated with designs that would be prohibitive because of their cost were they in stone. It will have a cellar and three stories, with nine rooms. The walls are to be 12, 10, and 6 inches thick in the various parts. The interior will be handsomely ornamented, making no further decoration work necessary after the molds are removed. If it is desired to heighten the inside effect, tinting can be resorted to. In addition to the enrichments, all of these dwellings will have elaborate chimney pieces. The roof imitates tiling and can be painted to suit the owner's taste.

Owing to the perfect insulation secured, both to the steam pipes, and to the rooms themselves from the outside cold, but one-quarter the coal ordinarily required is needed to heat these dwellings. By keeping the doors and windows closed, they can be kept correspondingly cool in summer. This manner of building is not economical for putting up single houses, owing to the cost of the initial outlay, although this outlay is in the nature of a permanent investment, as the plant is practically indestructible. On the other hand, for constructing, say a thousand houses, in proximity to each other, it is very suitable. For instance, suppose that it is desired to lay out an industrial village. After the positions of the various buildings are staked out, a large gang of laborers digs the cellars, and the mold for a house is set up, the operation taking about twelve hours. The running in of the concrete requires twelve hours more, and after seven days the molds are removed, and the next house is erected.



DETAIL OF EDISON CONCRETE HOUSE.

According to Mr. Edison, the actual cost of a dwelling made according to this method would be one thousand dollars. The wear and tear on the molds and the interest on the outlay, he figures at about fifty dollars a house. This makes the total cost $1,050 for a house that in the quarter-size model in Mr. Edison's laboratory bears every mark of refinement and comfort.

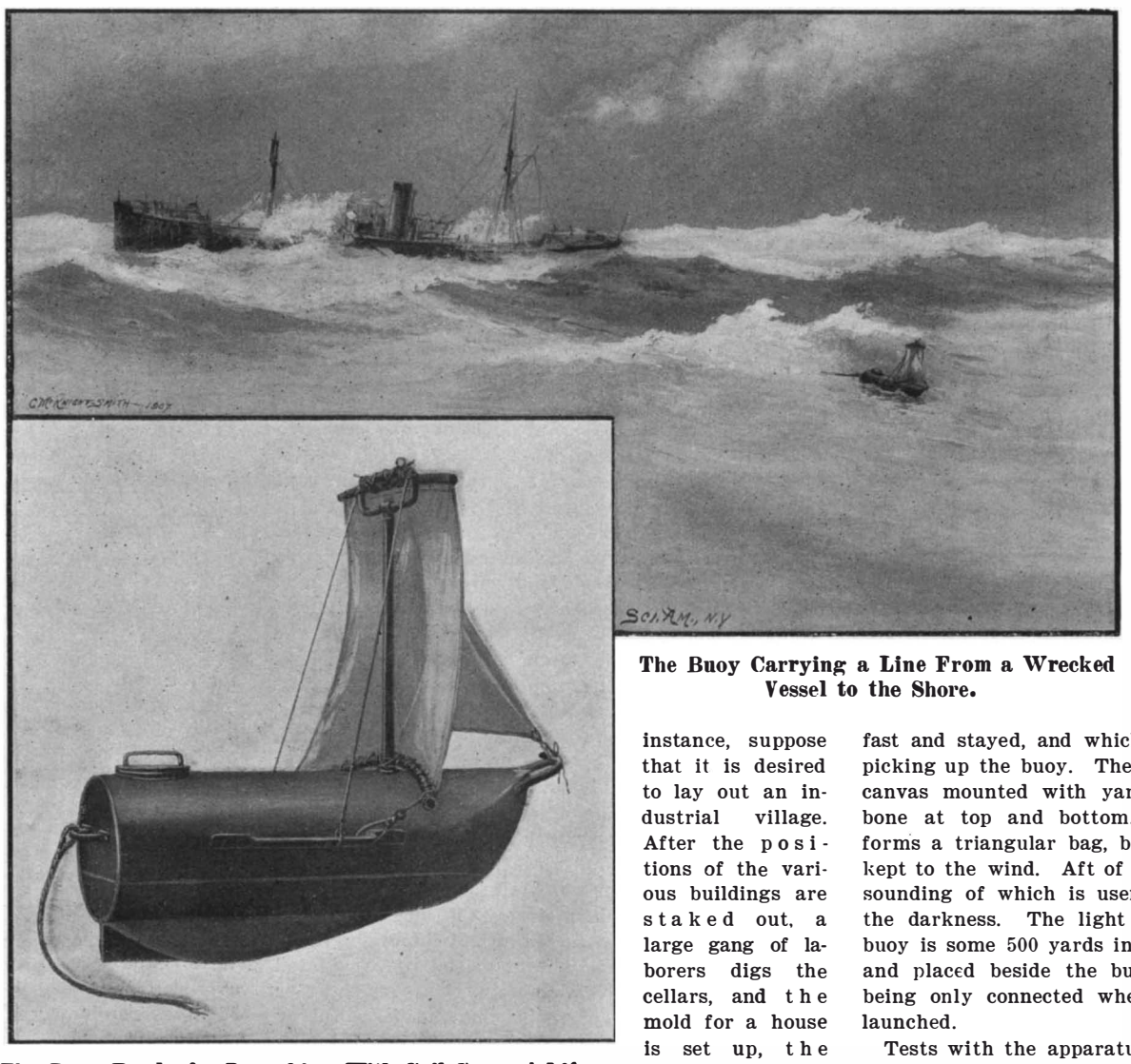
The architects who have designed the house for Mr. Edison are Messrs. Manning and Macneille, to whom we are indebted for the accompanying detail view.

THE BREDSDORFF STRANDING BUOY.

BY THE ENGLISH CORRESPONDENT OF SCIENTIFIC AMERICAN.

In order to facilitate communication between a stranded ship and the shore, where conditions prevent the utilization of the rocket life-saving apparatus and render it impossible for a lifeboat to be launched, the novel stranding buoy shown in the illustration has been devised by Mr. T. Bredsdorff, a director of the Flensburger Shipbuilding Company, of Flensburg, Germany. This device was suggested by the wreck of the English steamer "Berlin" off the coast of Holland a few months ago, when it was found impossible to succor the wrecked passengers and a heavy death roll resulted. The distance was too great for the rocket to be fired over the ship. Similar disasters are of frequent occurrence; and as in such circumstances the wind and sea are always driving shoreward, this new buoy should be of great service when other methods fail, since owing to its light draft it can be carried right to the beach.

As may be seen from the illustration, the buoy resembles in shape a small boat fitted with a sail and with a light rope connected to the stern, which after launching is paid out from a revolving reel on the deck of the wrecked boat, and which when picked up on the shore serves to enable a heavier cable, capable of carrying the life-saving cradle, to be hauled shoreward. The buoy is 3 feet in length by 18 inches beam, 12 inches deep, and draws 8 inches of water. It is strongly constructed of yellow metal and copper with the ribs or frames of metal, and tin coated, and with a rounded deck. There is a heavy lead keel tapering both fore and aft, so that the boat can always maintain an even keel, no matter how rough the sea or surf. Aft of the mast, which is placed well forward, are two water-tight bulkheads, dividing the internal space into three water-tight compartments, in which a small supply of provisions, ships' papers, or other communications can be placed, and which minimize possibility of the buoy foundering by collision with wreckage or rocks. The center compartment is fitted with a water-tight cover 5 inches in diameter, and similar covers at either end close the fore and aft compartments. There are four hand grips placed on the outside of the buoy, one on either side and fore and aft, which not only serve for the purpose of making fast the line, or landing the buoy by means of a boathook, but also afford facilities for persons in the water to keep afloat, since the buoy will support three people.



The Buoy Carrying a Line From a Wrecked Vessel to the Shore.

The Buoy Ready for Launching. With Sail Set and Life Line Attached.

THE BREDSDORFF STRANDING BUOY.

The mast is made of brass piping, formed at the top into an oblong ring, to which the sail is made fast and stayed, and which is used for launching and picking up the buoy. The sail is of strong waterproof canvas mounted with yards of Spanish reed or fish bone at top and bottom. On the foreside the sail forms a triangular bag, by which the buoy is always kept to the wind. Aft of the mast is a small bell, the sounding of which is useful for locating the buoy in the darkness. The light pilot line connected to the buoy is some 500 yards in length, wound up on a reel and placed beside the buoy on the captain's bridge, being only connected when the buoy is about to be launched.

Tests with the apparatus have shown that when it is thrown overboard in a heavy wind blowing on shore, it travels at a speed ranging from 1 to 1½ knots per hour, and invariably is caught up by the rollers and

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thrown well on the beach, so that it can be easily secured by those on shore, and the heavier carrying rope can either be hauled from the vessel to shore or *vice versa* by means of the light pilot line.

The apparatus is also capable of a variety of other applications, such as the transmission of ropes in towing in a rough sea, the hauling alongside and making fast of pilot boats and lifeboats, which otherwise would be impossible owing to the seaway. It is also suggested that the buoy should be carried on every vessel, so that in the event of a ship foundering in mid-ocean the ship's papers could be placed in it, and the buoy cut adrift to be picked up by some other craft or on some coast. It would be more efficient for this purpose than the bottle or barrel generally adopted. The buoy is painted a bright red, or given a brilliant polish, and with its white sail it is a conspicuous object during the daytime, while the tinkling of the bell facilitates its recovery during the night.

A NEW AMERICAN AEROPLANE.

BY JOHN MILLER BONBRIGHT.

A heavier-than-air flying machine which lacks the faults of former similar devices, according to its inventor, J. W. Roshon, of Harrisburg, Pa., will be given a trial near that city in the near future. The machine was rushed in its final stages in order to have it completed in time for the aeroplane contest at St. Louis for the SCIENTIFIC AMERICAN trophy, but delay in the arrival of materials prevented its being in readiness.

Fig. 1 shows the aeroplane in front of the building especially built for its construction, with the inventor in the foreground. Fig. 2 is another view showing the engine, propeller, and propeller-shaft, as well as the great height of the machine.

The Roshon aeroplane is constructed of aluminium and steel tubing, bamboo, steel wire, and canvas. It is 24 feet wide, 8 feet deep, and 17 feet high. The upper tier of planes is 12 feet wide.

The three principal supporting surfaces are composed of a series of narrow planes arched at the front edge, and flattening out as they approach the rear. These three surfaces are at the top, middle, and bottom of the machine, extending from end to end. The arched planes number eighteen.

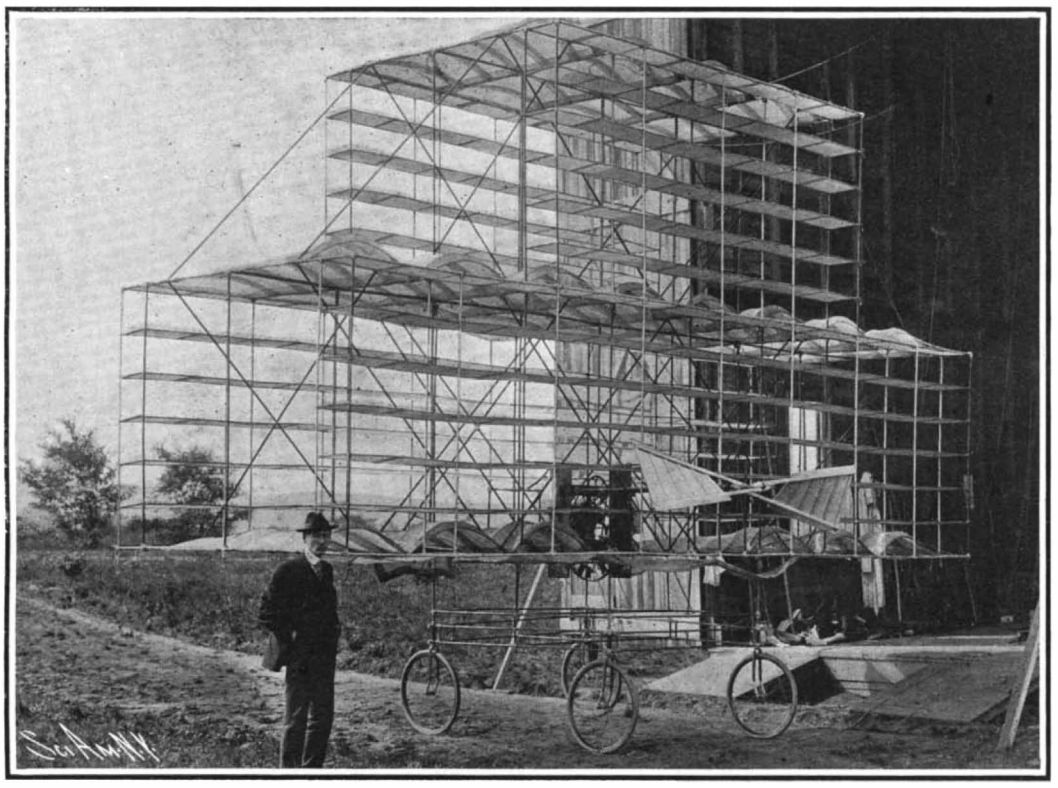


Fig. 1.—The Roshon Aeroplane and Its Inventor.

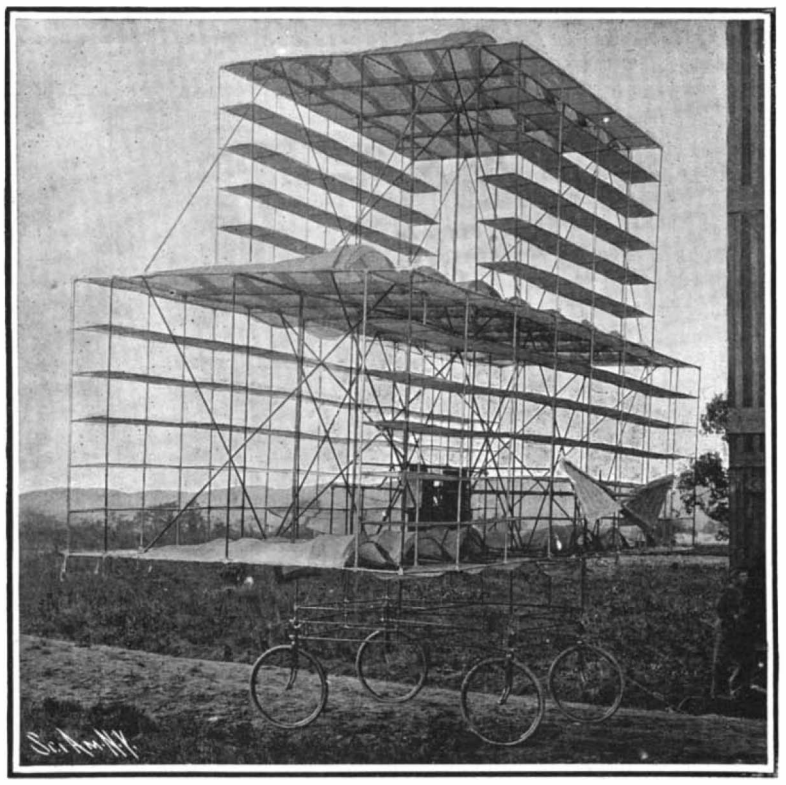
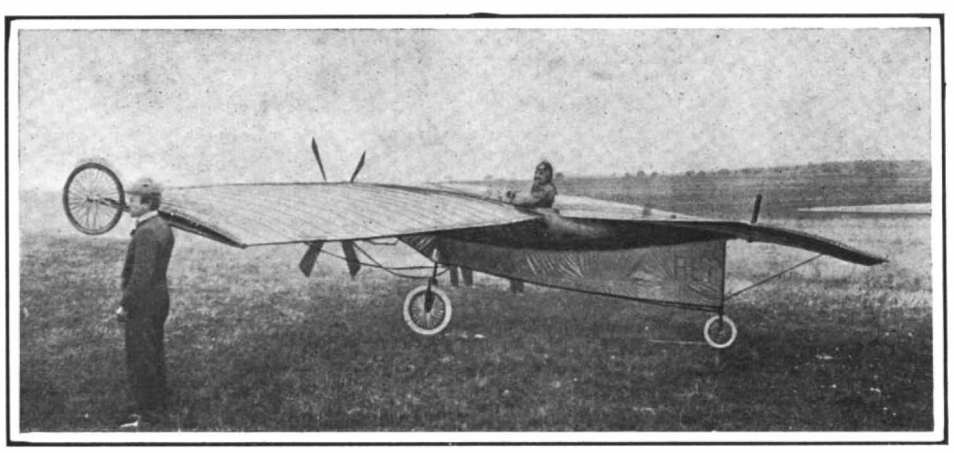


Fig. 2.—Side View of Roshon Aeroplane.

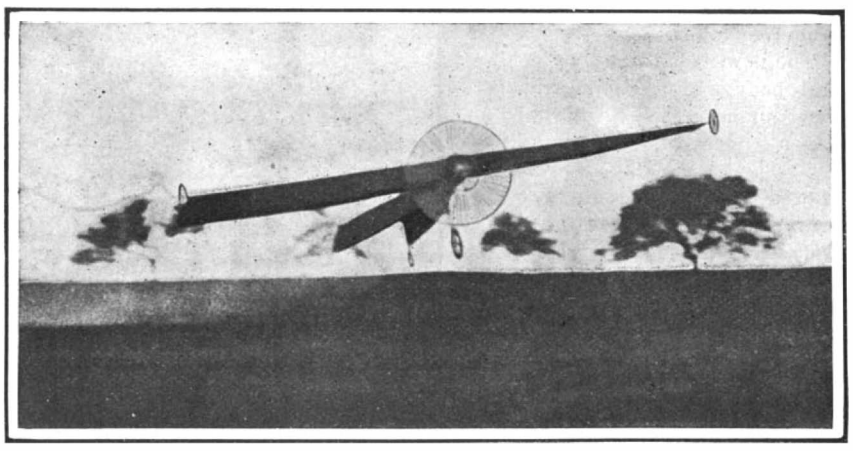
Besides the arched planes there are twenty-six narrow flat planes placed transversely at the front and rear of the machine. All the planes are of canvas. Their total area is 900 square feet.

The engine, shown near the lowest set of arched planes, is a 7-horse-power double-cylinder gasoline motor of the air-cooled type. Its weight is 50 pounds. The engine is geared to the propeller shaft, which it turns at the rate of 200 revolutions a minute.

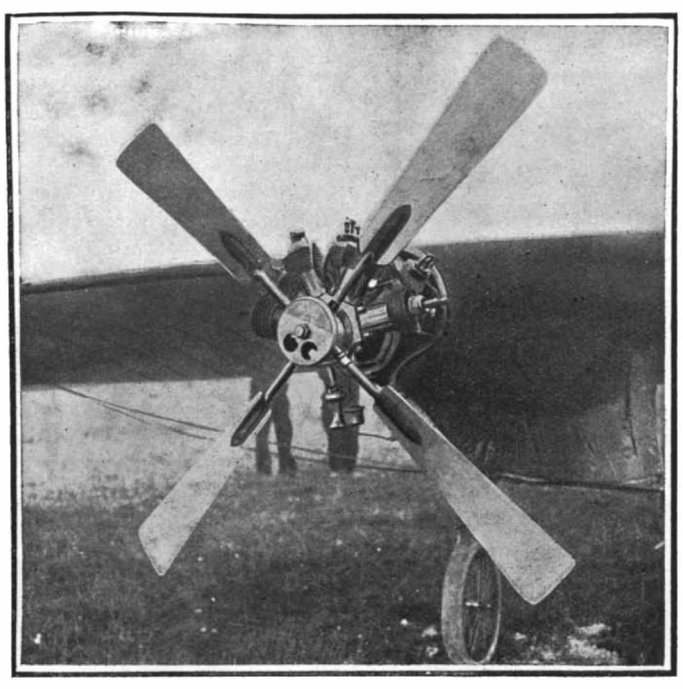
The propeller is 9 feet in diameter, the pitch of the blades decreasing from the innermost edge toward the ends. The propeller is at the front of the aeroplane, and it revolves in a clockwise direction.



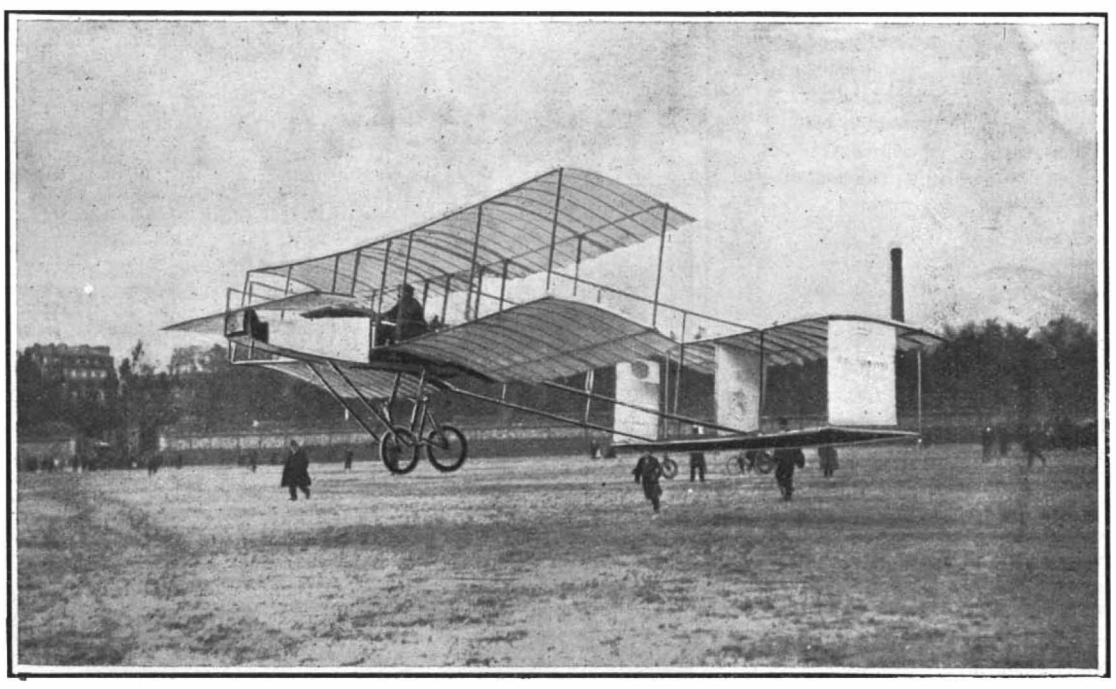
Rear View of Pelterie Monoplane, Showing Wheel on End of Plane.



The Pelterie Monoplane in Flight.



The 7-Cylinder Motor and 4-Bladed Propeller of the Pelterie Monoplane.



M. Farman Making a Flight of Nearly Half a Mile Above the Drill Grounds at Issy on October 26.

THE LATEST FRENCH AEROPLANES AND THEIR RECORDS.

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The seat for the operator will be attached movably in the framework beneath the engine, within easy reach of the levers which control it. There are no horizontal or vertical rudders, the inventor intending to steer by shifting the center of gravity by moving in the operator's seat. In flight it will be necessary for the operator to sit forward of the center of gravity, to prevent the entire machine from tipping backward. To ascend, he will move backward, and to descend, he will move forward. Turning to the side will be effected by inclining the machine by a lateral shift of the operator's position.

Four wheels at the bottom of the framework support the aeroplane on the ground. The bicycle wheels shown were used at first, and were found to be too light.

The first test will be without an operator, a bag of sand supplying the required weight. After the center of gravity has been accurately determined by experiment, the inventor will take the operator's seat.

An inclined plane has been constructed near Mr. Roshon's workshop. It is 25 feet high, with a steep descent, the floor curving upward at the lowest point. The aeroplane will be taken to the top, and with the propeller turning at full speed, will be allowed to descend the grade. The rise at the bottom is intended to start the machine skyward.

The total weight of the aeroplane, without an operator, is 450 pounds. With an operator, it will weigh 600. The area of the planes is 900 square feet. Each square foot of sustaining surface will therefore have to support only slightly over a half pound (0.66 pound) of weight. This is much less weight per square foot than is imposed upon the planes of other devices which have proved successful.

Mr. Roshon, who is a photographer, has been working on his device for a year. He has been studying the theory of aerial flight for years, however, and has also studied other airships. He believes he has avoided the errors made in the others. One of the strong points about his machine is its compactness.

THE LATEST FRENCH AEROPLANES AND THEIR RECORDS.

THE PELTERIE MONOPLANE.

An aeroplane which is attracting considerable attention at Paris is the invention of M. Robert Esnault-Pelterie, an aeronaut of great scientific ability as well as practical skill. For some time past M. Pelterie has been making a series of calculations and experiments with small models, and recently he built the large full-sized aeroplane shown in the accompanying illustrations and made several short flights with it over the plain at Buc, a point not far from Versailles.

The new flyer has a long central body and a single transverse plane, which gives it the general appearance of a butterfly. The plane is somewhat curved from its front to its rear edge. At the rear of the body is a flat plane used as a horizontal rudder, while the motor and propeller are placed at the front of the main body in advance of the single aeroplane. Joined to the bottom part is a light frame carrying a pair of wheels for traveling upon the ground. The 25-30-horse-power air-cooled motor is built according to the inventor's designs and is of a somewhat unusual construction, having seven cylinders staggered and arranged in a circle. It is of light weight, its total weight in running order being but 44 kilogrammes (97 pounds) which makes it weigh between 3 and 4 pounds per horse-power.

The machine illustrated has a supporting surface in its single aeroplane of 18 square meters (193¾ square feet); but the reconstructed machine will have only 16 square meters (172¼ square feet). The total weight of the flyer with operator is 240 kilogrammes (529.1 pounds), of which the motor and propeller make up 55 kilogrammes (121¼ pounds), the rudder, wheels, and gasoline 10 kilogrammes (22 pounds) each, the aeroplane 60 kilogrammes (132¼ pounds), the framework 20 kilogrammes (44 pounds), and the operator 75 kilogrammes (165 pounds). The new aeroplane was recently tried for the first time near Paris.

The first trial was made at 2:20 P. M. on the afternoon of October 22. After the aeronaut had seated himself in the machine, the motor was readily started, and the aeroplane was released. It ran along the ground lightly like a bird taking flight, the wheel on the end of one wing touching the ground gently as

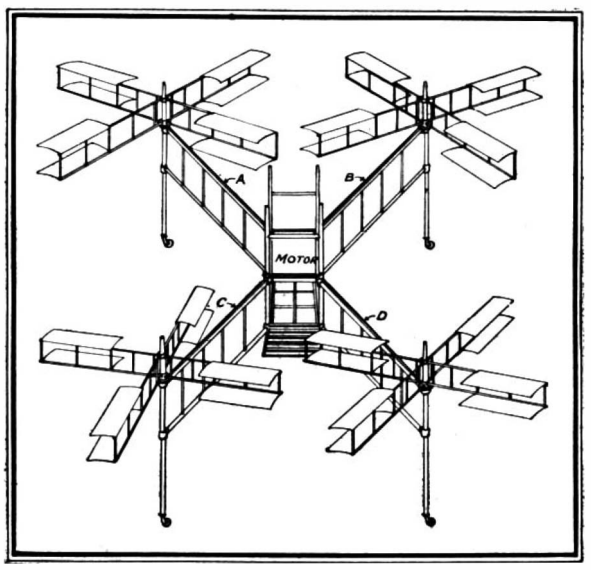


Diagram Showing Arrangement of Motor and Revolving Aeroplanes.

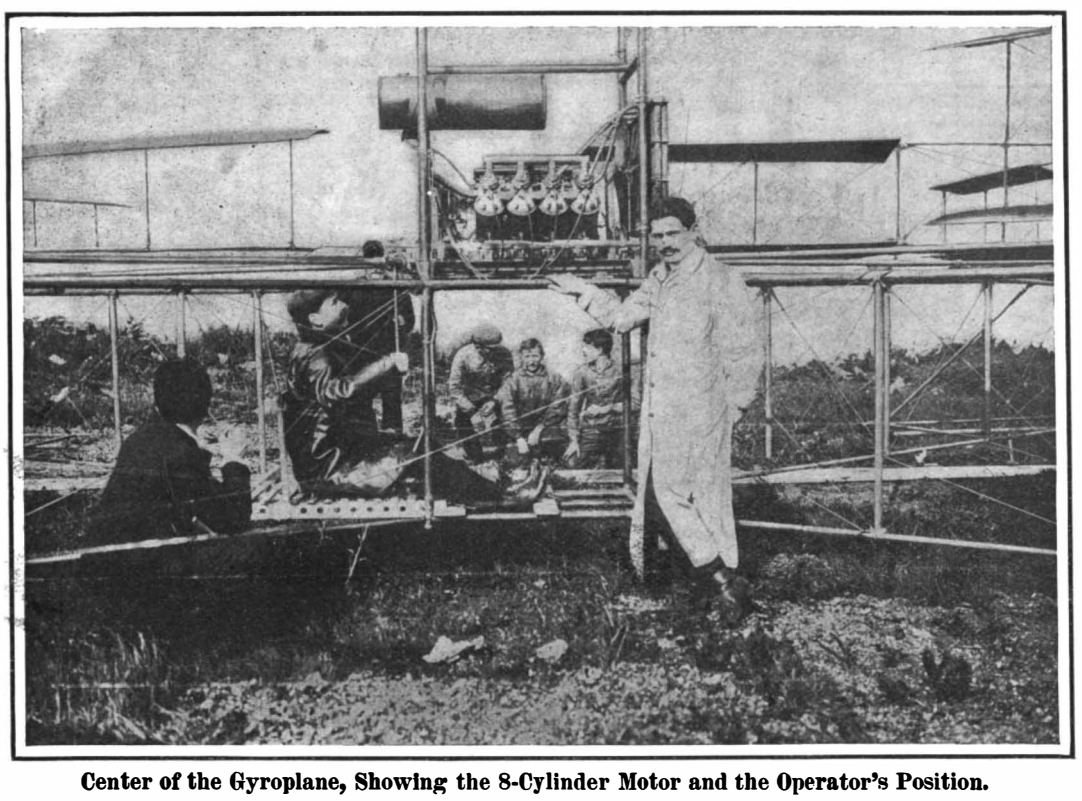
the machine tipped to one side. After running some 64 feet, the machine had attained a speed estimated at about 37 miles an hour. M. Pelterie operated the horizontal rudder, with the result that the aeroplane rose off the ground and made a flight of about 328 feet at a height of 5 or 6 feet. It dropped lightly to the ground and ran on its wheels for about 65 feet, after which it again rose in the air a few feet and, in a very graceful curve, described a semicircle having a radius of about 1,640 feet. M. Pelterie then cut the ignition current, and the machine once more landed lightly without damage.

At 2.40 P. M. a second trial was made. This time the machine was started in the high grass and on very uneven and rough turf. It again responded to its horizontal rudder, and rose in the air when going at full speed. This time it made a flight of about 492 feet, and rose to a height of from 20 to 25 feet. Instead of coming down gently and running along the ground, the machine suddenly dropped almost vertically. Although the shock of the fall was a severe one, the wheels, motor, propeller, etc., were not damaged; but the wooden framework and aluminium braces gave way, and one end of the monoplane (which is made in two halves) was broken. The inventor had two new planes ready, but as it was a matter of several days to replace the broken half, no further flights were made on this particular day. The new machine is to have less sustaining surface, yet the inventor estimates it will leave the ground at a speed of 31 miles an hour instead of 37. The width of the plane will be 8.6 meters (28.21 feet) instead of 9.6 meters (31.49 feet). The Pelterie aeroplane resembles the monoplane machine with which M. Bleriot experimented unsuccessfully last spring. The machine is mounted on but two wheels placed in the same vertical plane beneath the center of the body. The idea of having wheels on the ends of the plane appears to be new, and it seems to have worked out well in practice.

FARMAN'S RECORD FLIGHTS.

M. Henri Farman, who has been carrying on a series of experiments with his new aeroplane at the drill grounds of Issy, near Paris, recently had a brilliant success, and in a flight made on the 26th of October he covered a distance of no less than 2,529½ feet. The delegates of the Aero Club were present on this occasion, with the official timekeepers, so that the result is registered in due form and thus constitutes the world's record for an aeroplane flight. Such a performance is most encouraging in the present state of aeroplane work. Hitherto Santos Dumont held the record for the longest flight, and the record of 220 meters (721 feet), covered in 21 1/5 seconds, which he made as far back as November 12, 1906, had hitherto not been surpassed, in spite of the efforts made by the numerous experimenters in the field. We have already given a description of M. Farman's aeroplane, with some of the principal data, referring also to a flight of 285 meters (935 feet) which he made not long since; but as this was not officially observed, it could not be taken as a record, although it already exceeded Santos Dumont's flight. During several days after this, M. Farman made a number of flights, covering distances of 300 to 600 feet. In these flights the aeroplane showed a remarkable stability and it was well under control, keeping at different heights above the ground of between 12 and 18 feet. It alighted without any difficulty, thus demonstrating its staunch construction. Most of these distances were officially observed, and some of the flights were carried out in the presence of Grand Duke Leopold-Salvator, of Austria, as well as M. Archdeacon, Capt. Ferber, Louis Bleriot, and others. On the 26th of October, M. Farman commenced the series of flights which ended in establishing his present record. In the morning he made four successive flights in very good condition, these being 120 meters (393.7 feet) at 3 meters (9.84 feet) height; 85 meters (278.87 feet) at 4 meters (13.12 feet) height; 112 meters (367.45 feet) at 3 meters height; and 180 meters (590.55 feet) at between 4 and 5 meters height. At 11 o'clock he made a fine start and succeeded in covering 363 meters (1,190.94 feet) in a straight flight, and recommencing the experiments in the afternoon he started at 2 o'clock and made a flight of 403 meters (1,322.17 feet). After this the Aviation Commission of the Aero Club was convoked upon the grounds. At 4 o'clock he succeeded in covering 350 meters (1,148.29 feet) at 3.5 meters (11.5 feet) height in 27 seconds, measured by Messrs. Peyrey and Voisin, with the time taken by M. Archdeacon. In the final flight he steered diagonally across the drill grounds, keeping a height of 6 meters (19.6 feet) and covering a distance of 771 meters (2,529.52 feet). He stopped at thirty feet from the inclosing wall by a skillful maneuver, and were it not for this obstacle he could have gone farther. A great crowd was assembled on this occasion, and much enthusiasm was manifested at this remarkable re-

General View of the Gyroplane Showing the Four Sets of Revolving Aeroplanes.



Center of the Gyroplane, Showing the 8-Cylinder Motor and the Operator's Position.

THE BREGUET GYROPLANE.—A NEW TYPE OF HELICOPTER.

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sult. M. Farman wishes to continue his experiments so as to try to solve the difficult problem of steering in a curved line, and as he has the flyer under good control we may expect some interesting results. Should he be successful, he will make an entry at the Aero Club to compete for the Grand Aviation Prix for one kilometer (0.621 mile) in a closed circuit, which is offered by Messrs. Deutsch and Archdeacon. His machine is apparently capable of winning the SCIENTIFIC AMERICAN Trophy, as it has already covered three-fourths of the distance required to be made by the first winner. One of our illustrations shows Farman's aeroplane in flight.

In connection with the above description of M. Farman's recent flights, the appended letter from him to the editor of "The Car" may be found of interest to our readers:

"The machine on which the recent trials were carried out is of the cubic type; that is to say, it is formed of two linen cubes, a large one at the front being 12 meters in length, 2 meters in width, and 2 meters in height, the other smaller at the rear, attached to the first by means of wood rods. A point-shaped car finishes this machine and holds the motor, the tanks, the driver's seat, and the operating apparatus of the motor. The equilibrator is placed at the front of the car, and the rudder at the back.

"To leave the ground is still not an easy matter, but to fly is still much more difficult. I succeeded in leaving the ground every day during the last two months, but it is only quite recently that I managed to make a flight of a distance of 285 meters, thus beating M. Santos Dumont's record. Unfortunately, this flight was not controlled by the necessary officials, but this is only of slight importance, as I am absolutely convinced that I shall succeed in making most interesting flights.

"Up to the present all flying machines constructed lacked stability. At every experiment they were smashed in landing; whereas I am glad to say that notwithstanding my several flights, varying between 100 to 285 meters, nothing in my apparatus broke or gave way; besides, it stands absolutely horizontal.

"However, I am unable for the moment to fly more than 600 or 700 meters; for once in the air, one of the two following things happens: I rise too high, and my present motor is not sufficiently powerful to produce the work necessary to lift the apparatus, weighing 500 kilogrammes, to between 5 and 10 meters, or else a wrong movement is given to the equilibrator, which brings me back to the ground. This can be remedied once I have my machine well in hand, and after more practice. One important point is the regulation of the motor, which will render it more efficient, so as to compensate the errors in the driving of the machine which are unavoidable at the beginning.

"As an indication of the difficult nature of the work, the following are the different parts which I have to survey and handle for the driving of my apparatus: The rudder at the rear, the equilibrator, the advanced ignition, the carbureting handle, manometer for water pressure. Moreover, I have to move from right to left according to the direction taken by the machine. I have also to keep the machine face to the wind. The crowd usually present also calls my attention, and my movements are somewhat impeded. I must also observe the motor explosions, as the least irregularity in these would bring me immediately back to the ground. All this is very difficult and complicated, but with practice and skill I am sure to succeed.

"My hopes are unlimited, and I expect to be able one day to travel at a rate of 100 kilometers per hour with a flying machine; for I am convinced that the aviation problem is solved in principle, and that in the near future progress will be such that a journey at a rate of 100 kilometers per hour will be just as possible in the air as on the road. For the moment, I limit my ambitions to the accomplishment in a few months of a flight of a kilometer."

On November 7 M. Farman twice beat his best previous record of 771 meters. The longest measured flight on this date was 800 meters (2,624.66 feet). In a subsequent flight during the same afternoon his machine is said to have covered fully 100 meters more, or a total distance of 900 meters (2,952¾ feet) in 70 seconds. In this flight the machine made a double turn in the shape of the letter S, and accomplished this maneuver with excellent stability.

THE BRÉGUET GYROPLANE.

Up to the present, most of the flying machines which have been brought out by leading aeronauts, on the Continent, at least, have been of the aeroplane type. Another type is the combination of a small dirigible balloon and one or two aeroplanes placed beneath it. This arrangement is also heavier than air and is made to soar by the action of the planes. There have been but few machines of the flapping-wing type constructed as yet. Still another form of flyer, and one which is of great interest, is the helicopter, in which the lifting action is brought about by two horizontal propellers revolving in opposite directions. Up to the present, inventors do not seem to have had much success with this form of machine, but recently a new flyer has been brought out in France which is to use the helicopter principle. It is at present in the first stages of experiment, but the inventors have already demonstrated that it has ample lifting power to rise in the air vertically and at the same time to lift a man. It now remains to adapt a propelling mechanism to the flyer in order to make it travel horizontally, and this the inventors propose to do in the next stage of the experiment.

The new flyer, which is shown in our illustrations, was built at Roubaix in the Bréguet establishment, under the direction of Messrs. Louis and Charles Bréguet and Prof. Richet. It differs essentially from what has been constructed up to the present, both as to the ideas involved and also in the execution. In this case the lifting action is obtained by the reaction upon the air obtained from four gyratory systems, each of which consists of eight revolving aeroplanes. A motor placed in the center of the apparatus is connected, through horizontal shafts and bevel gears, to the four vertical shafts of the revolving aeroplanes, and these are all driven at the same time. Each of the gyratory systems consists of an upper and a lower horizontal rod mounted on a vertical tubular shaft and connected together by vertical braces. At the outer ends of the rods are mounted small aeroplanes which give the whole the appearance of superposed four-bladed propellers of large diameter (26½ feet). The inventors claim that on account of their special arrangement they utilize the gyroscopic action of the revolving aeroplanes, which, they claim further, gives the machine perfect automatic stability in the air. At any rate, the application of the gyroscope principle to an aeroplane is of interest and may lead to some very practical results. For this reason the inventors give the name "gyroplane" to the present apparatus.

As to the mechanical design of the new helicopter, the present apparatus is merely a first experimental form made in order to demonstrate the lifting power. The main frame of steel tubes which carries the whole is built in the form of a St. Andrew's cross. In the middle part is mounted the gasoline motor, which is of the extra light-weight, eight-cylinder, V-type, capable of developing a maximum of 45-horse-power. The aeronaut's seat is placed below the motor, and above it is located the gasoline tank. At the four ends of the long horizontal tubes that extend out from the motor are placed four vertical shafts fitted with castors at their lower ends and carrying tubular sleeves to which are secured the horizontal rods of the eight aeroplanes.

The use of twin planes is said to give a better equilibrium in the air. There are thirty-two surfaces divided into four sets and giving a total area for the flyer of 26 square meters (280 square feet). They are driven at a speed of 48 revolutions per minute, and describe a circle of 8.1 meters diameter (26½ feet), corresponding to a speed of 26.4 meters (86½ feet) per second at the center of action. The total weight of the flyer when mounted by an aeronaut representing 70 kilogrammes (154 pounds) is 540 kilogrammes (1,190 pounds). The motor weighs 170 kilogrammes (374 pounds) in this case. In the trials of the lifting power it was found that at the above speed of the planes the apparatus could rise in the air and keep itself off the ground at a height of a few feet, but as it was not equipped with steering devices it was considered unwise to make any more than a demonstration of the lifting power, and therefore the helicopter was held by hand so as to prevent it from rising higher. When the motor was slowed down, the machine settled down on the ground very easily and without shocks. To avoid any accident from a false maneuver, the lifting test was limited to one minute, but there is no doubt that it could keep in the air for a long time under the same conditions. The inventors have thus proved the value of their theories as to the gyroplane in a striking manner, in view of the fact that they were able to raise and hold a weight of 1,169 pounds in the air. Supposing the motor to have developed 40 horse-power at 1,380 R. P. M. (the speed at which it ran), it will then be seen that the gyroplane lifted 29.2 pounds per horse-power. In reality, however, it probably did even better than this, which shows that the new arrangement is rather efficient despite its cumbrousness.

The area and curves of the aeroplanes were determined from the following formulas:

R = the vertical reaction obtained by the system of revolving aeroplanes.

n = the number of revolutions per second of these systems.

D = the diameter of the circles described at the periphery of these same systems.

W = the power absorbed in kilogrammeter-seconds to drive these systems, including the transmission losses.

P = the weight of a complete system of revolving aeroplanes.

From these symbols we have the following relations:

$R = 0.017\, n^2 D^4$.

$W = 0.0075\, n^3 D^5$.

$P = 0.6\, D^2$.

It should be noted that on account of the method of construction employed, the weight of the machine increases only as the square of the diameter instead of as the cube, which was the relation found by Col. Renard, and as a result of which he found it practically impossible to build a helicopter with sufficiently large propellers to lift a man and a motor.

Correspondence.

The St. Louis Balloon Race.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of November 2 your interesting article on "The Long-Distance Balloon Races from St. Louis" contains a chart, "The Finish of the Race," giving the order of finish. You make an error in placing "St. Louis" fourth and "America" fifth. This should be reversed, as "America" finished fourth and "St. Louis" fifth. As the SCIENTIFIC AMERICAN promises to become the authority on aeronautics in America and will be quoted extensively, this error should be corrected, especially as it carries with it the record for the American team.

J. C. McCOY,
Pilot Balloon "America."

New York, November 3, 1907.

The Long-Distance Balloon Race from St. Louis.

To the Editor of the SCIENTIFIC AMERICAN:

In a description of the long-distance balloon races from St. Louis in the SCIENTIFIC AMERICAN of November 2 occur the following statements: "The German owes its victory to the accident of being a mile or two farther north than its competitor, where the coast runs in an easterly direction." "Major Hersey was the one competitor who has made a close study of air currents in this country, and he was the one man who was able to find and hold the northeasterly course which the aeronauts expected to follow."

It seems to me that these statements are both unkind and ungenerous to the winners of the race. A reference to the chart you give shows that both the German and the French balloon, the "Pommern" and the "L'Isle de France," were well to the north as well as to the east of St. Louis when they landed. That they did not go as far north as the lake region, and become entangled in the lakes, which compelled Major Hersey to descend, was in accordance with a well-laid prearranged plan. Certainly, I know in the case of the German balloon, it was planned to move northeastward well south of the lakes, and reach the Atlantic coast as far north as possible. This movement was executed with such precision that the course followed by the balloon from St. Louis to a few miles south of New York was only about fifty-six miles longer than a straight line joining the two places, the pilot arriving at this place over four hours earlier than his nearest competitor, and with nearly one-third of the ballast with which he started still unused. That he did not get some fifteen or twenty miles farther north, pass across into New England and land on the New England coast, probably as far north as Maine, was due entirely to the fact that, unfamiliar with the country, he lost his bearings somewhat on the evening of October 22, and went a little farther south than he intended. In order to use the air currents to advantage, the Germans had sought the assistance of the director of the Blue Hill Observatory, near Boston. The staff of this observatory had made a thorough study of the air currents at Boston, and at St. Louis by means of clouds, kites, and sounding balloons, and certainly were well equipped for aiding and guiding the balloonist. As one of these meteorologists was in the basket of the winning balloon, it is not fair to say that Major Hersey was the one competitor who had studied air currents. To say that the leading German and French balloons won their positions because their pilots had excellent balloons, had shown great skill in their management, and had selected as aides scientific experts who were capable of helping them by their knowledge of air currents and by taking observations of latitude and longitude from the baskets of the balloons, is a kinder and, in my opinion, a more truthful way of stating the case than by the statements which I have quoted.

HENRY HELM CLAYTON,
Meteorologist of the Blue Hill Observatory.

In many business offices fire buckets are placed, filled with water in readiness for an emergency. It is seldom that instructions for use are pinned near the supply. The wrong way to tackle an incipient fire is (usually) to hurl the whole contents of a bucket on the spot. Most of the water is wasted by this means. A heavy sprinkling is more effective. The water may be splashed on the blaze by hand, but a more useful sprinkler is a long-haired whitewash brush. One of these should hang beside every nest of fire buckets.

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THE VIENNA SERUM INSTITUTE.

BY OUR BERLIN CORRESPONDENT.

In hardly any branch of medicine have theoretical results found such rapid and successful practical utilization as in bacteriology. Within a few decades bacteriology has been developed to a science which even specialists have some difficulty in covering in its totality. This rapid growth is easily understood, for the very aim of this doctrine is to free humanity from its most terrible foes, infectious diseases.

Among its most important achievements are doubtless the introduction of antisepsis in surgical practice and the discovery of the diphtheria serum by Von Behring.

Prof. von Behring in 1892 found that animals treated with virulent diphtheria cultures generate in their blood serum some protective substance or anti-toxin. Apart from protecting the animals themselves this anti-toxin will render other subjects immune from diphtheria toxin or infection by diphtheria microbes.

The most important point of Prof. von Behring's work in conjunction with Kitasato and Wernicke, however, consisted in demonstrating that the serum, apart from its protective virtue, possessed curative qualities.

An extension of the experience gained in connection with animal experiments to human practice was, however, far from being as easy as would appear at first sight. In fact, the percentage of anti-toxin in the serum of immune animals had to be increased sufficiently to allow therapeutical effects to be obtained on diphtheritic patients by vaccination with small amounts of a serum. Furthermore, owing to the frequency of diphtheria, means had to be provided for permanently producing the therapeutical serum in large quantities. Extensive institutes were set apart for its production and the analyzing of its composition. The same institutes further had to deal with the problem of extending to other diseases the ideas which had proved so fertile in connection with diphtheria and tetanus. Owing, however, to the difidence at that time produced by the disappointing results of Koch's tuberculine, much difficulty was experienced in obtaining the necessary funds.

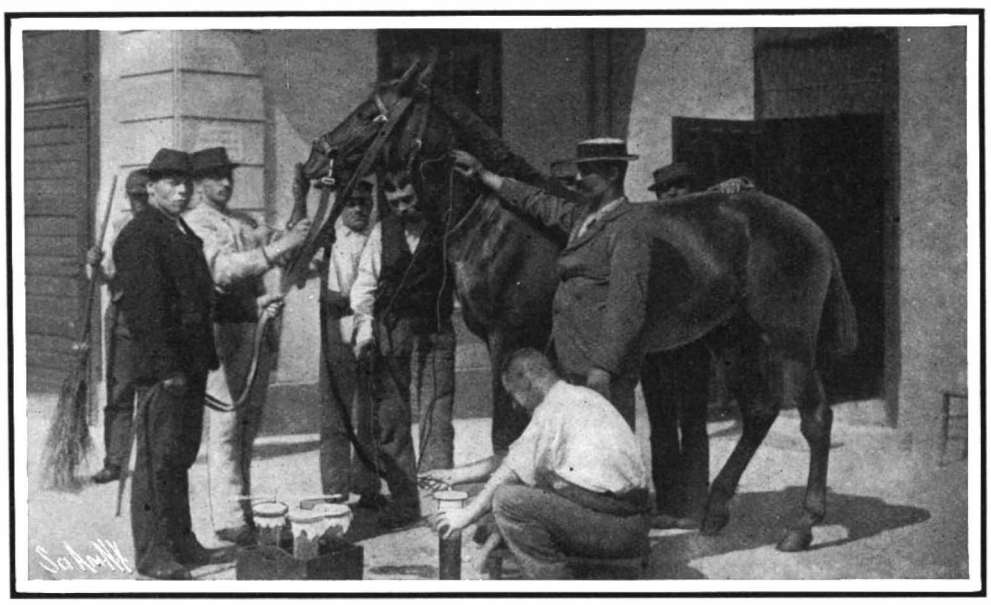
One of the first and most important serum institutes is the Vienna Institute, founded by Prof. Paltauf with funds provided in part by the Austrian government and partly by an anonymous benefactor. In addition to supplying the whole amount of diphtheria serum consumed in Austria, this institute is engaged in general research work on sero-therapeutics.

Horses are at present used exclusively for yielding serum, and these are mostly young horses (four to eight years old) which should be perfectly healthy, though foot defects would not prove an objection. These animals are housed in large, light, and well-ventilated stables, the floor, walls, mangers, etc., of which are of washable material and are kept scrupulously clean. Care is taken in the feeding of the animals as well as in insuring cleanliness and frequent exercise in the open air.

These horses are rendered immune by a subcutaneous injection of diphtheria virus close to the neck, using every precaution to warrant a perfect antisepsis. A graduated calibrated cylindrical vessel, the lower end of which is connected through a piece of rubber tubing with a needle that is thrown under the skin of the animal, is used to make the injection. Its upper end connects with a rubber pump.

The horses will react to the injection of toxin with both local symptoms (swelling of the vaccinated parts) and general symptoms (fever, depression, diminution of appetite, etc.), but after one or two days normal conditions will be re-established. In the case of excessive doses, especially at the beginning of a treatment, dangerous phenomena and even death may occur. Owing to their increasing immunity, the animals, which are vaccinated on an average every four or five days, will eventually stand enormous quantities. In fact, while a few drops of a violent virus may prove fatal with a first inoculation, a quart will afterward fail to exert any strong reaction. After two to three months the treatment will be finished, and the horses may now be used for producing therapeutical serum. But in many cases a horse will form only small quantities of antitoxin, and the sera of such animals will be useless, enormous quantities being required for obtaining curative effects.

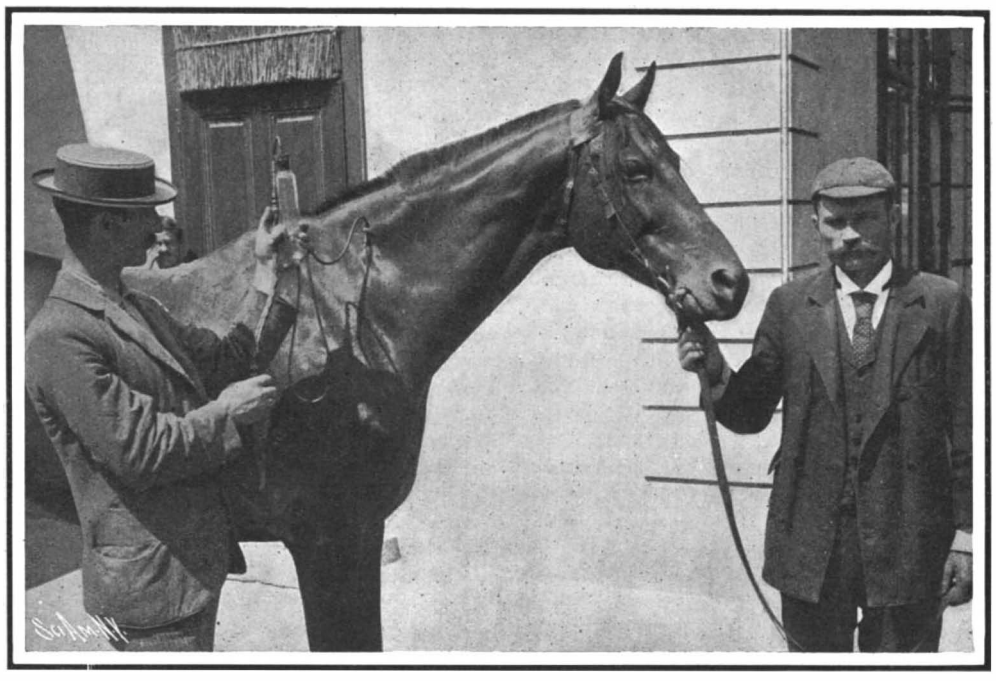
The first thing to be done is therefore to ascertain whether a given animal will yield antitoxin, which can only be done by practical test; if not, it should be used for other purposes. Serum institutes are therefore compelled to keep larger numbers of animals than would be necessary for supplying the required quantities of serum. In many cases a horse supplying no diphtheria serum will be suitable for yielding other protective substances. The blood of the animals is derived by bleeding, the jugular vein at the neck being compressed with a pelotte, and a sterile trocar being thrown into the vein. The trocar is connected through a rubber tubing with big sterile glass vessels, in which the blood is allowed to accumulate. Six liters (about six quarts) of blood are generally derived, after which the compression and subsequently the trocar are removed, when the small wound will heal after a few days. The vessels filled with blood are placed in special cooling compartments, in which, owing to coagulation, the blood will be separated into the black-red clot of blood, which will sink to the bottom, and the clear gold-yellow serum, which remains at the top.



Drawing the Serum From a Horse.

Each 6 quarts of blood will yield an amount of serum varying between 1½ and 2.1 quarts. After twenty-four hours the serum is removed by means of syphons from the clot of blood, and after standing a few days, is tested as to its sterility and efficiency by animal experiments, and is then filled into small flasks, in which it is sold.

All these manipulations require an enormous amount of care and accuracy, as well as considerable technical skill. Working with serum is complicated considerably by the necessity of avoiding any pathological impurities, lest the whole serum fraction be destroyed by putrefaction. Any germ falling from the air into the serum, any contact with the hands or any non-sterile vessels or instruments, will involve this danger. In connection with the diphtheria serum, however, the resistance of the liquid can be increased by an addition of 0.5 per cent of carbolic acid, while in that of other sera an absolute absence of germs is the only guarantee of preservation.



Injecting the Virus Into a Horse.

THE VIENNA SERUM INSTITUTE.

In addition to diphtheria serum there are produced at the Vienna Institute some other therapeutical sera including an anti-dysentery serum. Dr. Kraus and Dr. Doerr conceived the idea that it should be possible to obtain antitoxins in the case of other infectious diseases, provided the microbe in question be isolated in an artificial manner. A solution of this difficult problem was found in the case of dysentery microbes. No obstacle was encountered in rendering horses immune with dysentery toxin and testing the efficiency of the serum, first on a sensitive animal and next on man. The first tests were made on soldiers. Patients who lay in their beds with pale cheeks, sunken eyes, and hardly noticeable pulse would frequently recover in a few hours after a single injection. Those patients who for the sake of comparison had not received any injection urgently asked for the treatment, which before their eyes had wrought such surprising improvement in the condition of their comrades.

In the case of typhus and cholera there also seems to be some chance of developing successful sero-therapeutical methods, and in connection with the laborious work carried out in this direction, the Vienna Institute has a considerable share.

Minimum amounts of these sera will by timely injection prevent the outbreak of infectious disease, as has been shown by experiment and statistics; and this adds greatly to the wide usefulness of these institutes.

Two Eggs a Day from a Hen.

In a recent issue of Science, Prof. Gilman A. Drew, who has been conducting experiments in connection with the egg-laying possibilities of hens at the Maine Experiment Station, quotes instances of hens which have laid two eggs within twenty-four hours. The most interesting case is that of a pullet, which apparently laid two eggs in one day early in March, 1906.

During March and April there are records of five days on each of which this hen laid two eggs. Although she was carefully watched for more than a year and a half, there are no other records of her having laid more than one egg in a day. It should be added that the records of days on which she was known to lay two eggs came during the months of her greatest egg-producing activity.

Prof. Drew has noted a number of instances of hens laying two eggs in a day, but the records show that in most cases on either the day before or the day after that on which two eggs were deposited no egg was laid. Such cases may reasonably be accounted for by supposing premature or delayed delivery, but this cannot be true of the hen whose record has been given, where, for the five days beginning with April 3 and ending with April 7, eight eggs were laid.

There are two other instances where an average of more than one egg in a day for a limited period was made. In both of these cases the possible mistake in the reading of the numbers on the distinguishing bands by which the hens are identified is to be considered.

There are eight other instances recorded where hens laid two eggs in a day, but in all of these cases on either the day previous or succeeding the day on which two eggs were laid no egg was laid.

More interesting than these abnormal occurrences is the report of hens which at the station have laid 255 eggs within twelve months.

Cleaning Objects of Aluminium.—To restore luster to tarnished aluminium it is sufficient to immerse it in water slightly acidulated with sulphuric acid. To small articles of aluminium a soft brush may be applied. For the bath, water with a little carbonate of soda will suffice.

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THE MARBLE QUARRIES OF CARRARA.

BY DAY ALLEN WILLEY.

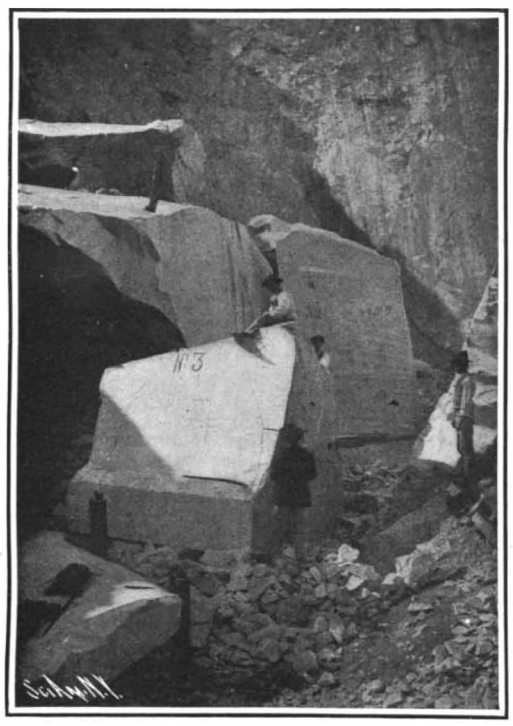
Few, if any, industries in the world have a greater percentage of waste than marble quarrying as it is done in Italy, yet the famous Carrara deposits have been worked over 2,000 years, and according to the statements of experts who have examined the mountains of marble in this locality, the quality of high-grade material yet to be excavated is so great that Carrara promises to supply the present rate of demand for its marbles for centuries to come.

When Nature created this section of the Apuan Alps, she formed a storehouse of marble that is truly marvelous in extent, for beds of the finest quality of the Carrara grade are known to exist as high as 5,500 feet above the level of the sea. The exact depth is unknown, as the deposits have as yet not been thoroughly investigated by the use of machinery. Test borings which have been made, however, show that a considerable portion of the mountain formation in the commune of Massa, in which Carrara lies, seems to be entirely of marble, and it is believed that in places the formation extends fully 500 feet downward, with not even a layer or thrust of other stone. One reason why the extent of the resource has thus far been merely guessed at, so to speak, is because so much of it is hidden by great masses of debris—the waste from workings that date back many centuries. The quarrymen of olden times opened the beds which were most convenient on the mountain slope, and much of the refuse fell into valleys. Some of these piles are hundreds of feet in thickness, and the labor of removing them would require so much time and expense, that it would not be profitable until the formation now so accessible has been taken out, and the marble advances in price.

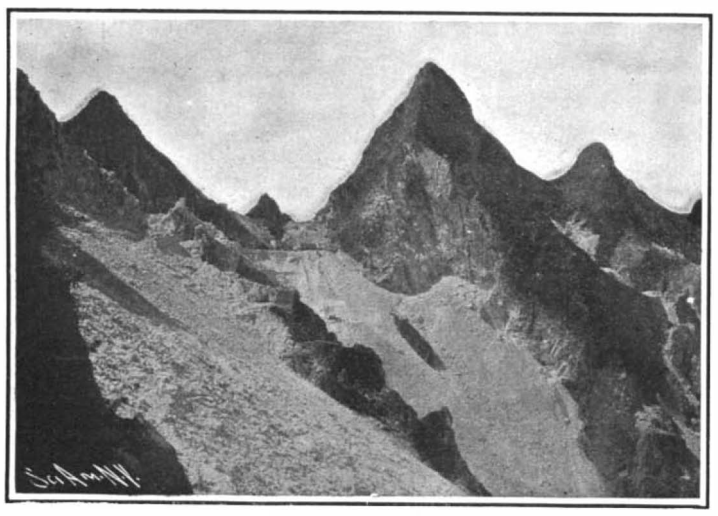
The grain of the marble quarried at the present time is said to be fully as fine as that secured a century ago, as is shown by comparing the blocks with the waste taken from the older workings. It still has a greater reputation among sculptors than the Pentelic, Hymetian, or even the finest Parian, both by reason of its grain and the fact that it can be fashioned with such ease into statuary and other forms. In recent years the quarries of Carrara have had an annual aggregate output of about 200,000 tons. They supply the bulk of the marble used in Italy and Europe to-day for sculpture and other ornamental work, while, as is well known, a large amount is sent to the United States, in blocks in the rough or in the finished form.

These deposits are quite accessible, especially since the principal workings are now reached by a railway which connects them with the principal shipping point—the little seaport of Avenza on the Gulf of Liguria. Avenza is really only three miles from the town of Carrara itself, but the quarries are distributed over an area which extends several miles beyond its borders. The nearest large city is Pisa in North Italy, thirty-two miles distant. Most of the marble at it comes from the quarries to Avenza is placed on sailing vessels and small steamers and carried to Genoa and Leghorn, where there are extensive marble works. These cities are also the principal places for shipping it to other parts of Europe as well as America. At the present time about six hundred quarries in all are in actual operation. Of these, more than half are in Carrara or its vicinity, about fifty are in the city of Massa, and the rest scattered principally in the commune of Massa. They give employment to about 6,000 men and boys, and are the sole support of a population of nearly 75,000 in this part of Italy.

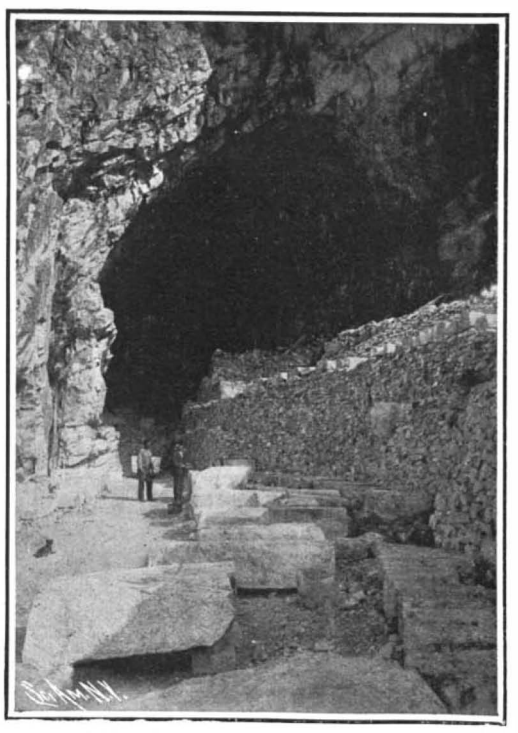
As in other old industries, tedious and wasteful



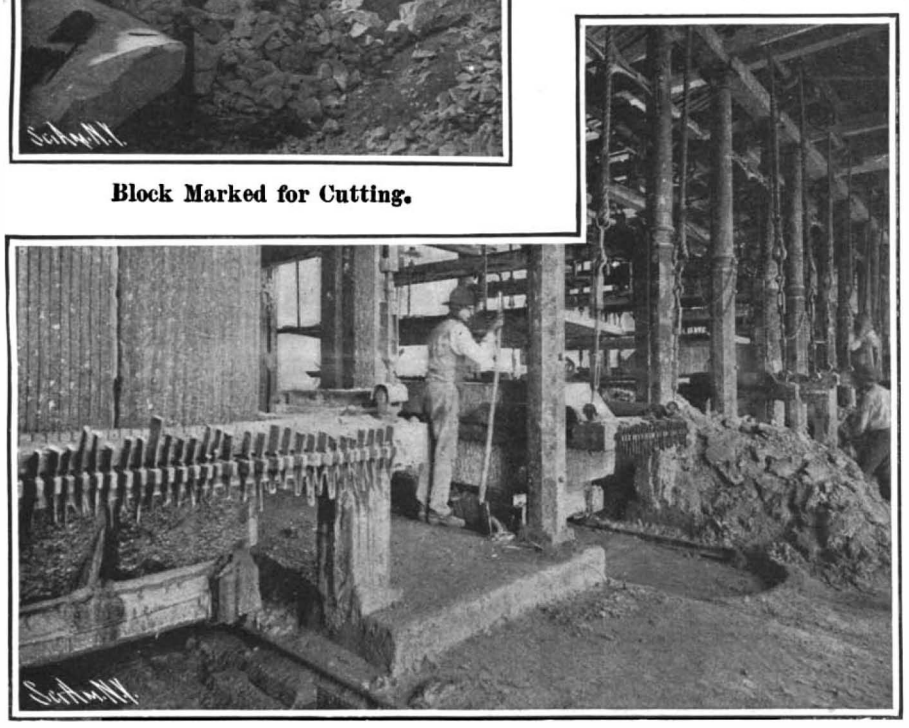
Block Marked for Cutting.



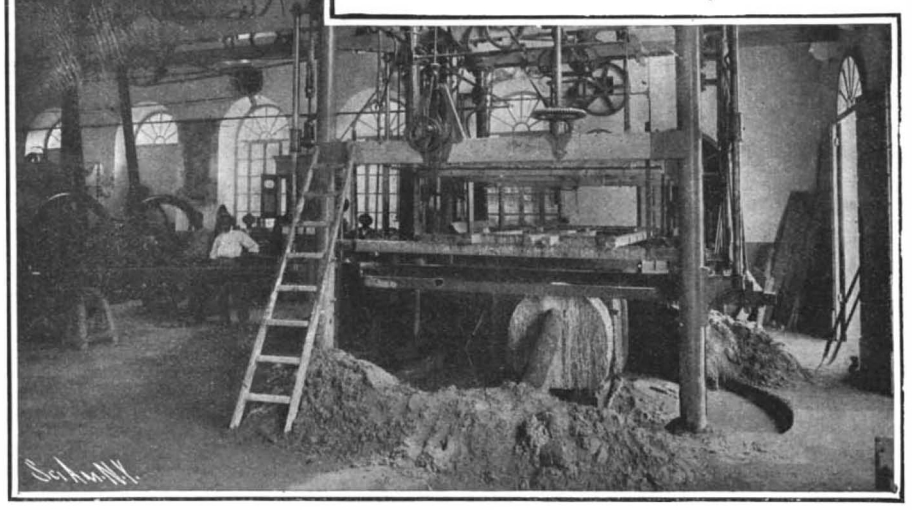
Marble Crags at Carrara



White Marble Quarry Entrance.

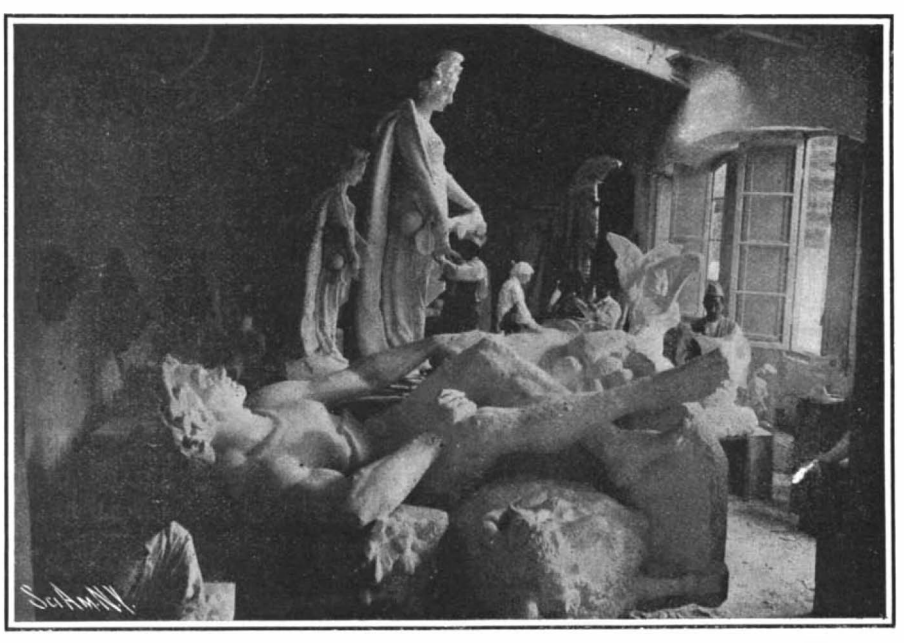


Slab Cutting Saws Operated by Steam and Water Power.



Steam Power Marble Planers.

Where Carrara Sculptors Learn Their Art.



Making the Gigantic Statues.

Photographs by Brocherel

THE MARBLE QUARRIES OF CARRARA.

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methods are still employed extensively at Carrara. Although steam and electric-driven machinery for stone cutting has been invented for a period of years, the Italians continue to use hand drills extensively, and employ explosives freely in getting out the material, so that the visitor familiar with the system in America regards their antiquated ways with surprise. In the Vermont quarries, for example, most of the blocks of all sizes are secured by channeling entirely with power tools. Where these cannot be placed in service, pneumatic and electric-driven drills are substituted. The channeler travels back and forth on a track which is pinned to the solid rock, making a ridge or channel which averages one and one-fourth inches in width and ranges from four to ten feet in depth. This incision is made parallel with the rails of the channeler track, but a few inches to one side. The machine cuts but one channel at a time, and in its operation is somewhat similar to the ordinary steam drill, with this exception, that the rotary motion is avoided. In order to cut the channel evenly, no less than five drills are assembled, each having a separate bit.

Another type of cutting machine is operated either by steam or electric power as desired. It is also moved back and forth on a track, but makes a channel on each side of the track and parallel with it. In this apparatus the drills are also arranged in clamps in groups of five, the up-and-down stroke of the drills where operated by steam being obtained through a double system of levers connected with a crankpin on the crankshaft of the engine. Between the levers is a system of springs, also between the lower lever and the frame, and the motion of the machine along the track is secured by connecting the crankshaft of the engine with the trucks through a system of gears. With this type of the channeler there is a constant relation between the speed of the machine and the strokes of the drill. When electricity is used in place of steam power, a connection is made between the electric motor and the shaft by means of bevel gears.

The use of this labor-saving mechanism is one reason why the American quarries can be operated at a profit, although most of the marble has to be lifted to heights ranging from 50 to 300 feet from the beds, necessitating the installation of powerful boom derricks and hoisting cranes. The Italians have one great advantage, owing to the elevation of so many of their quarries. As already stated, beds exist in the Apuan Alps at an altitude of 5,500 feet, while many of the workings are more than 2,000 feet above the sea. Therefore, much of the expense of derrick machinery is avoided, and the force of gravity is an economical factor that partly makes up for the enormous waste incurred by the methods of quarrying. While some of the lessees have installed drills actuated by steam and electric power, such are only occasional instances, much of the drilling being done with the hand-power ratchet type of drill. Neither the channeler nor any other apparatus for grooving the marble has yet been employed except in a few works, the bulk of the product being obtained by blowing it out. The holes are drilled where in the judgment of the quarry director the explosive will be most effective, but before being charged they are usually enlarged by pouring nitric acid into them, which eats away the interior. The explosive, which is usually blasting powder, is then inserted. In recent years the electric current has been introduced to ignite it, but in many of the larger operations the fuse is still employed.

The charges are not always so distributed that the block desired is loosened, so a second blast is frequently necessary to completely detach the mass, when some of the needless surface is cut off on the spot with chisel and mallet. Then the material is ready to be transported to the marble mills in the valley or to Avenza for shipment by water. As the quarry may be several miles from the railroad, advantage is taken of its elevation. If it is a very large piece, an inclined plane may be made, down which the block slides upon a wooden sledge, controlled by ropes fastened about it, which are run through pulleys, so that the speed can be regulated. At the foot of the incline it is jacked up on a clumsy but strong cart drawn by oxen. Sometimes a string of twenty or more of these beasts are hitched to the cart by means of wooden yokes of the pattern used a hundred or more years ago. Thus it is transported to the railroad or mill.

To save the expense of transporting refuse material, a considerable amount of the marble is sawed and finished at Carrara, but here again most of the work is performed by antiquated machinery. Plants where the slabs are actually sawed by hand are numerous. A crude frame somewhat resembling the old-fashioned American bucksaw, but much larger, holds the saw blade, which is usually of steel and when new is about five inches in width. This is pulled back and forth across the surface of the stone by two men, one at each end of it. Water flows along the cut from a wooden trough resting on one end of the block, and thus the metal is cooled. The work is so slow, however, that a groove four inches deep is considered a fair day's work, for which each man receives the equivalent of about thirty-five cents in American money. Recently several mills have been established containing gangs of saws moved by water power, as in Vermont, but they cut only a small portion of the marble. Power is used more extensively for operating the finishing tables, where the slabs are smoothed and polished while rotating beneath pumice and wooden polishing blocks, although some of this labor is still performed by hand.

Strange as it may seem, the Carrara deposits are not absolutely owned by any private individuals or companies. Since the era of the Roman republic, they have been what is termed state property in Italy. At one time they were under the control of the Bishop of Luni, the chief Roman city, which was located in this portion of Italy, being ceded to the Bishop in 1183. This will give an idea of the long time during which the quarries have been in operation. The present method of working them is for a person to lease a certain portion. The price paid the state for this lease, however, is so small that it is but nominal, and the lessee practically secures the revenue from the industry without any expense except that incurred for the wages of the laborers, the cost and care of the draft animals and the machinery which he may install. These are reasons why the processes followed are still so antiquated in comparison with quarrying in other parts of the world.

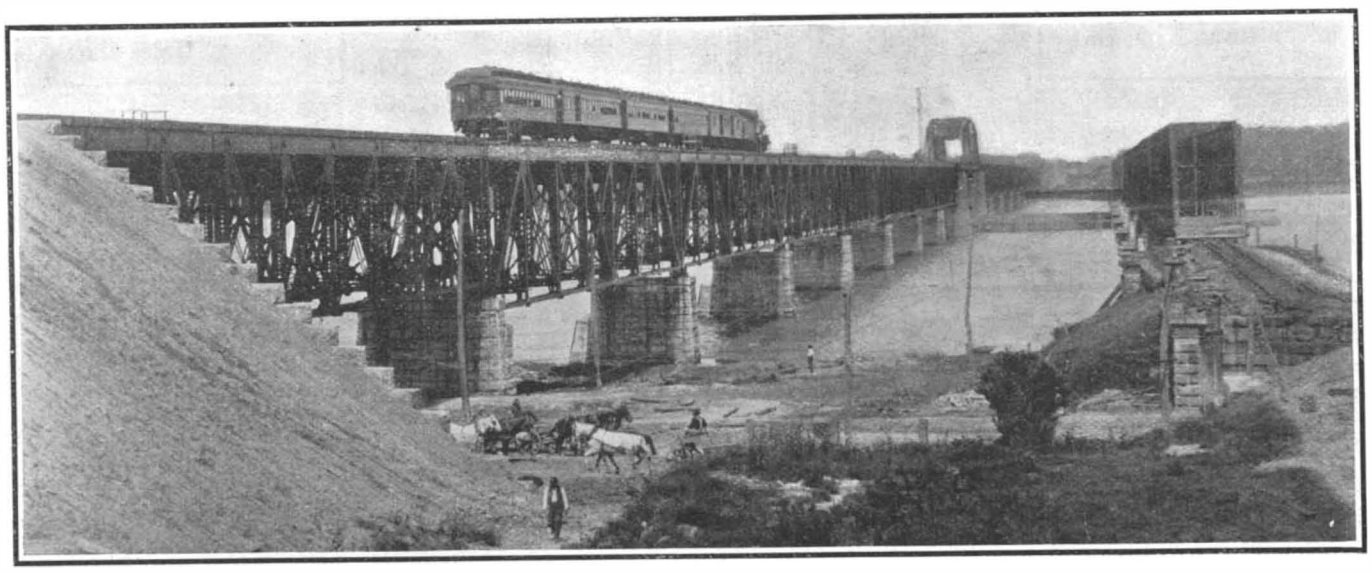
The different kinds of marble are not arranged in layers, but blend with one another like the colors of the rainbow. A little sandy coating covers the blocks, and divides each from the other. It is noticed that where marble is exposed to the sun, it becomes harder; where it is placed in the shade, it becomes finer and softer. From an admixture of metallic substances, the marbles are sometimes marked, speckled, veined, and spotted. Though the marbles are of great variety, they may all be reduced to threefold classifications of *brecciati*, *bardigli*, and *bianchi*. Although the elegant *brecciato* is much liked for ornaments, and the flowered *bardiglio* is useful, still it is the *bianco* which is of the greatest importance, and the white statuary marble is the noblest of all. It has many varieties. Sometimes it is of dazzling whiteness, sometimes it inclines to blue, sometimes to flesh color, as is the case with *crestola*, which is by far the most beautiful. It rises in value in proportion to its freshness, its tint, its crystallization, and the size of the piece. Its freedom from impurities is also a matter of much consideration. The *crestola* is the choicest of all, either on account of the beauty of its surface or because, from being less liable to chip, it can receive from an expert hand more finely chiseled and delicate features. A beautiful proof of the excellence of this marble was given by the sculptor Moli in his "Pompeian Mother," now in the possession of Mr. Mitchell Henry, of London. The woman, flying with her child from the disaster, tries to shield herself from the burning rain with some drapery or a sheet, which she holds high above her head. The air which she displaces in running swells the folds of the drapery, which, owing to the masterly way in which these folds are executed, and the delicacy of the work, is so fragile that it seems as thin and transparent as if it were linen. The most colossal monuments, however, the loftiest columns and the most sumptuous vestibules, are made of *bianco-chiaro*.

Nearly one hundred and fifty years ago the famous Academy of Fine Arts was established at Carrara; but as far back as the fifteenth century, these marble mountains attracted the sculptor, and the little city has long been one of the actual art centers of Europe, though seldom heard of compared with Florence and other Italian communities. Michelangelo worked here for years, and was one of the first *savants* to realize the extent and quality of the beds. Bondinella and many other masters of the chisel had studios in Carrara, and some of their creations are to be seen in the museum, which contains one of the most valuable collections of sculpture in existence, including pieces which date back nearly to the era of the Roman republic. Carrara has also been a great school for sculptors. It has been said that even the quarrymen inherit a talent for fashioning with the chisel, handed down through generations. Certain it is that a large number have become expert with the use of this tool.

THE NEW SUSQUEHANNA BRIDGE, PENNSYLVANIA RAILROAD.

The Pennsylvania Railroad is now rapidly completing portions of the vast scale of improvements it entered upon a few years ago. Even yet many people do not appreciate the heroic character of the work undertaken, but the company is already beginning to reap its reward in earnings and improved service, both freight and passenger.

An important link in this great chain of betterment is the practical making over of that section of the main line of the Philadelphia, Baltimore & Washington Railroad centering at Havre de Grace, Md., at the mouth of the Susquehanna River, and extending about 5½ miles, that is, as far north as Principio and as far south as Oakington.



THE NEW SUSQUEHANNA BRIDGE.

The principal feature of these improvements is a new steel and masonry bridge, about a mile long, over the Susquehanna River at Havre de Grace, Md. This bridge was built in fast time, and embodies many interesting features. The other changes were in line with the established policy of the Pennsylvania Railroad to eliminate grade crossings, reduce grades, and straighten out curves, wherever possible. These improvements mark another step in the plans of the company eventually to reduce the running time between New York and Washington to four hours, without sacrificing the slightest element of safety.

With this work completed, the main line of the Philadelphia, Baltimore & Washington has four tracks between these stations, except over the Susquehanna Bridge, which carries two. Not a grade crossing has been left, grades are reduced, and curvature is now at a minimum. The road has been built to serve its purpose at a small cost of maintenance, for an indefinite period of time.

The improvements center in the big bridge at the mouth of the river, and which is located about 150 feet north of the old structure. The ponderous character of this bridge may be realized from the fact that it contains 44,369 cubic yards of masonry and 20,230,384 pounds of iron and steel. The structure consists of seventeen fixed deck spans and a through draw span 280 feet long from center to center of the rest piers.

The first fixed span on each end is 196 feet 6 inches long; the remaining spans on the Havre de Grace end are each 200 feet long, and on the Perryville end they are each 260 feet long from center to center of piers. The fixed spans have a clearance of 24 feet 3 inches at mean tide, and the draw span has a clearance of 53 feet at mean tide. When opened, the draw presents a clear opening of 100 feet on either side for the passage of vessels.

The bridge rests upon twenty piers of Allegheny Mountain sandstone with concrete backing and Port Deposit granite coping. They are at right angles to

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the bridge, with the exception of the two rest piers for the draw, which are swung 14 degrees to the west, to bring them in line with the current of the river. Pier No. 1, the east abutment, was built by open cofferdam construction on rock at an elevation of 4.4 feet.

Excavation for piers Nos. 2, 3, and 4 was carried on by the open cofferdam construction, and in the case of pier No. 3 a depth of —32.0 feet was reached. From the bottom of the excavations piles were driven to solid rock. In the case of No. 2 pier, 294 piles were driven until their points were at a depth of —77.0 feet. Piers Nos. 3 and 4 each rest upon 390 piles driven until the points reached an average depth of —110.0 and —88.0 feet respectively. Piers Nos. 5 to 16 inclusive were built on pneumatic caissons at depths of from —22.3 to —87.6 feet.

Work was started upon the piers in the summer of 1904, but not much river work was done until the ice went out in 1905. The last masonry was laid on the fender pier December 16, 1905.

The fender at the draw is built of piles with a granite pier at the north end, and a timber crib filled with stone at the south end. The granite pier rests upon a caisson sunk to a depth of —44.8 feet, while the crib rests on the river bottom dredged to a depth of —30.5 feet.

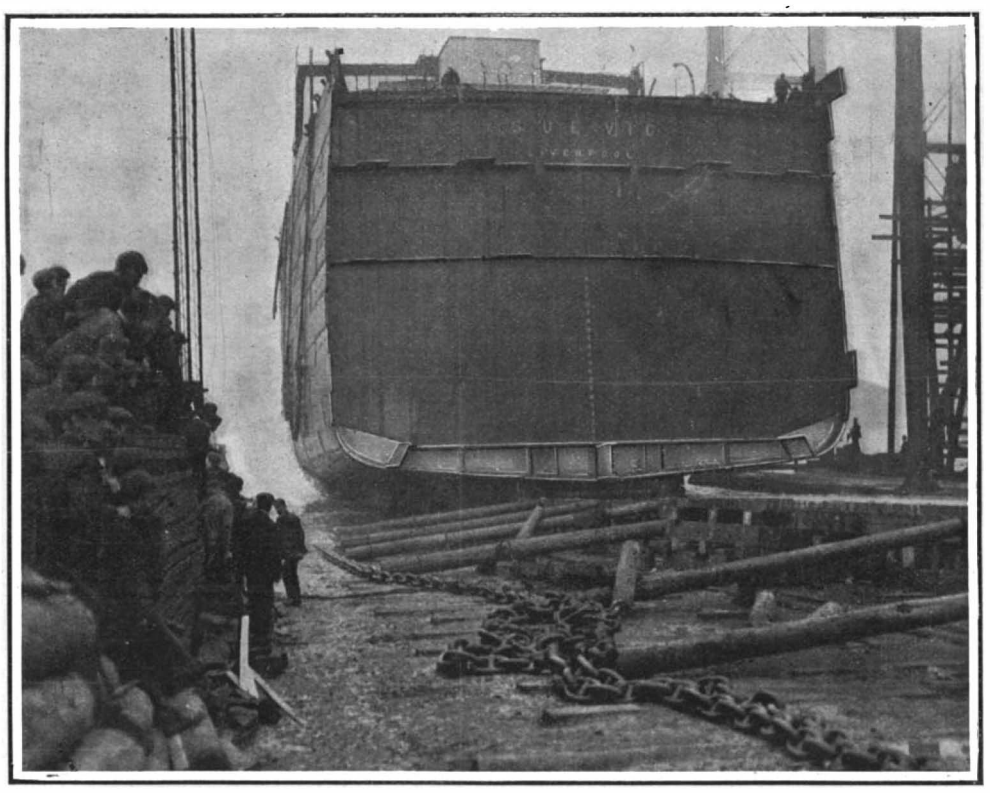
Erection of the steel work was begun August 10, 1905, and finished May 22, 1906. The draw span was erected on falsework over the fender, and swung into position May 19, 1906.

Industrial Alcohol.

Dr. Wiley, of the United States Department of Agriculture, in his conclusions on industrial alcohol, points out that the manufacture of alcohol on a very small scale is not likely to prove profitable. Experience has shown that attempts to manufacture sugar and other substances of a similar character on a small scale cannot compete with similar manufacturing industries on a large scale. Furthermore, any still for the distillation of spirits must be registered and conducted under the supervision of the internal revenue officers; and though no regulations on the subject exist, the rules in regard to output practically result in fixing the minimum size of a registered still as one making from 7 to 10 proof gallons per day. It is thus seen that it will not be practicable for the farmer to operate a still on a small scale under present conditions. Moreover, the still can only be shut down by an internal revenue officer, and thus it would not be practicable to conduct a small still in a desultory manner. The still must be constructed as prescribed by law and the process conducted in all its details according to the regulations of the internal revenue. It is evident that the farmer must be content with producing the raw materials and that he cannot look forward to becoming a practical distiller.

The benefits which are to accrue from the use of Industrial alcohol free of tax have probably been overestimated by the people at large, and especially by the farmers, but that material benefits will accrue is not a subject of doubt. These benefits will come, not suddenly but slowly, as agricultural products are more abundant, technical methods of manufacture improved, and the method of utilizing the industrial alcohol better understood. Our people should not, however, be disappointed should many years elapse before the magnitude of the product used for industrial purposes reaches the figure already attained by Germany and some of the other European nations.

Of the raw materials which can be utilized for the manufacture of alcohol, Indian corn is by far the most abundant and the most promising source at the present time. The average price of potatoes must be very much decreased before raw material of this kind can come into competition with Indian corn as a source of alcohol. Promising sources which are not now utilized for the manufacture of alcohol in this country are the potato, the sweet potato, the yam, sorghum, molasses from the sugar-cane and beet-sugar factories, and the Indian-corn stalk. Waste materials of other manufacturing industries, such as those related to fruits and vegetables, may incidentally be utilized for manufacturing purposes, but could not of themselves become independent sources of profitable industrial alcohol.



THE BOW OF THE "SUEVIC" ON THE WAYS

An Aeroplane Prize Offered by the Auto.

The offer by the SCIENTIFIC AMERICAN of an aeroplane trophy has caused much interest in Europe—so much that our esteemed Paris contemporary, Auto, has followed the example and offers a cup for aeroplanes. The idea is a simultaneous race, and the machine which covers the longest distance to be declared the winner. All the flyers would be assembled at the start, and would commence the race at a given signal. Judges would observe the distances for the finish, and two chronometers would take the total time for each machine. There would also be a number of judges placed along the course so as to see the probable point from which the flight took place. It is probable that the leading aeroplanes will be entered in the event, and it will certainly be novel to see the flyers drawn up in line.

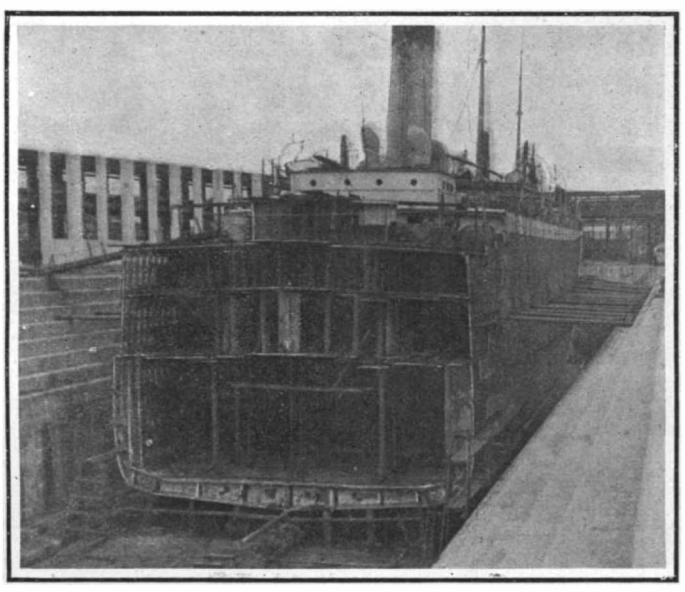
THE LAUNCH OF THE BOW OF THE "SUEVIC."

BY HAROLD J. SHEPSTONE.

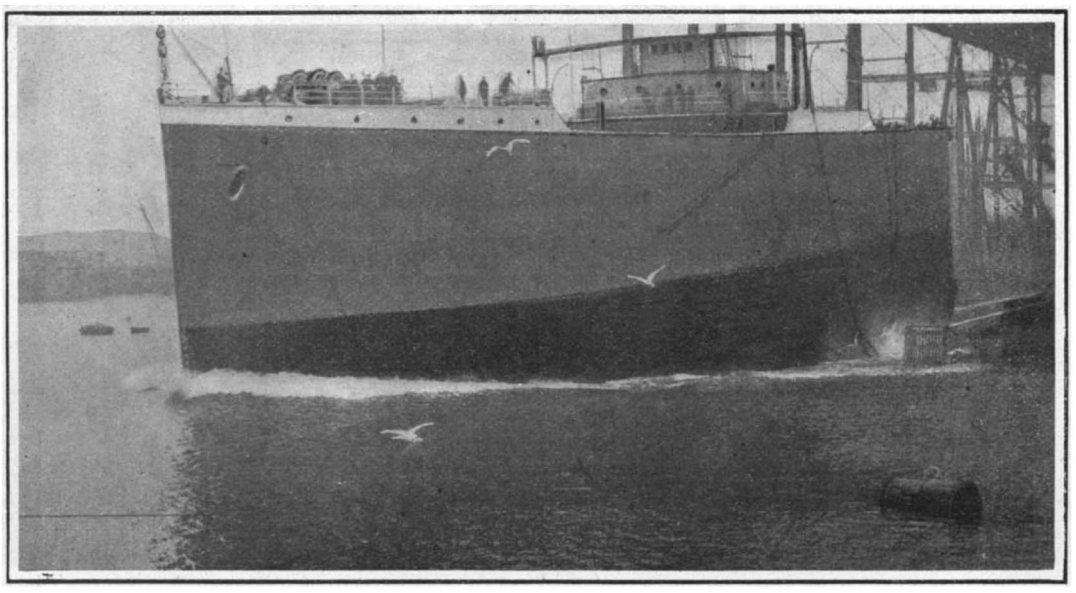
A launch of unusual interest was that accomplished at the shipyards of Messrs. Harland & Wolff at Belfast, when the new fore end of the White Star liner "Suevic" took the water. It will be recalled that this steamer went on the Stag Rock at the Lizard on the Cornish coast on March 17 last. The Stag Rock is one of the most, if not the most dangerous place around the British Isles, and it was considered by the majority of experts that the vessel would be a total loss; but after a careful examination, the owners and builders, along with the Liverpool Salvage Association, came to the conclusion that the greater part of the vessel might be saved by cutting her in two.

This operation was successfully performed with dynamite and gelignite. The after portion was drawn clear of the rocks sixteen days after the wreck, the "Suevic's" own engines assisting the tug by working full speed astern. This after portion, containing the engines, boilers, etc., the most valuable part of the ship, was towed to Southampton, the engines assisting in the steering by means of the twin screws, and it is now at the Trafalgar graving dock at that port. The old bow was hopelessly lost on the rocks, and is to-day entirely submerged.

It was decided at the time of the wreck to build a new fore end and fit it to the saved portion of the wreck. This work was intrusted to her original builders, Messrs. Harland & Wolff. The new portion, with deck houses, captain's bridge, masts, etc., complete, extends from the stem to the bulkhead aft of No. 3 hold, i. e., the fourth bulkhead from the stem, and it has a total length of about 212 feet. It was virtually this half of a ship that was launched and towed to Southampton. It is to be placed in the same dock where the after portion now is, when the two will be connected together and the ship made as good as when she originally left the builder's. There have been cases where ships have been joined together in this way, though they have been much smaller boats than the "Suevic." The "Suevic" is a twin-screw steamer of 12,500 tons, and was one of the five vessels specially designed and built for the White Star Australian trade. She was originally launched on December 8, 1900.



AFTER SECTION OF THE "SUEVIC," TO WHICH THE NEW BOW WILL JOIN.



THE NEW BOW OF THE "SUEVIC" TAKING THE WATER. THE BOW IS 212 FEET LONG.

Artificial Sapphires.

An analysis of a number of the imitation sapphires that have been flowing into this country from Paris was made recently by Prof. Alfred J. Moses, of Columbia University. He states that artificial stones contain more than 99 per cent of oxide of aluminium; the remainder being silica and coloring matter. True sapphires are composed of 97 per cent oxide of aluminium, 2 per cent iron oxide, and the remainder silica, etc. Physical differences are also marked, the artificial stones having a hardness of 8 as against 9 of the natural. The density of the former is also low, 3.62, compared with 3.97 in the latter. In color both stones have practically the same basic blue, but the artificial gem does not exhibit the same high degree of dichroism shown by the natural product.

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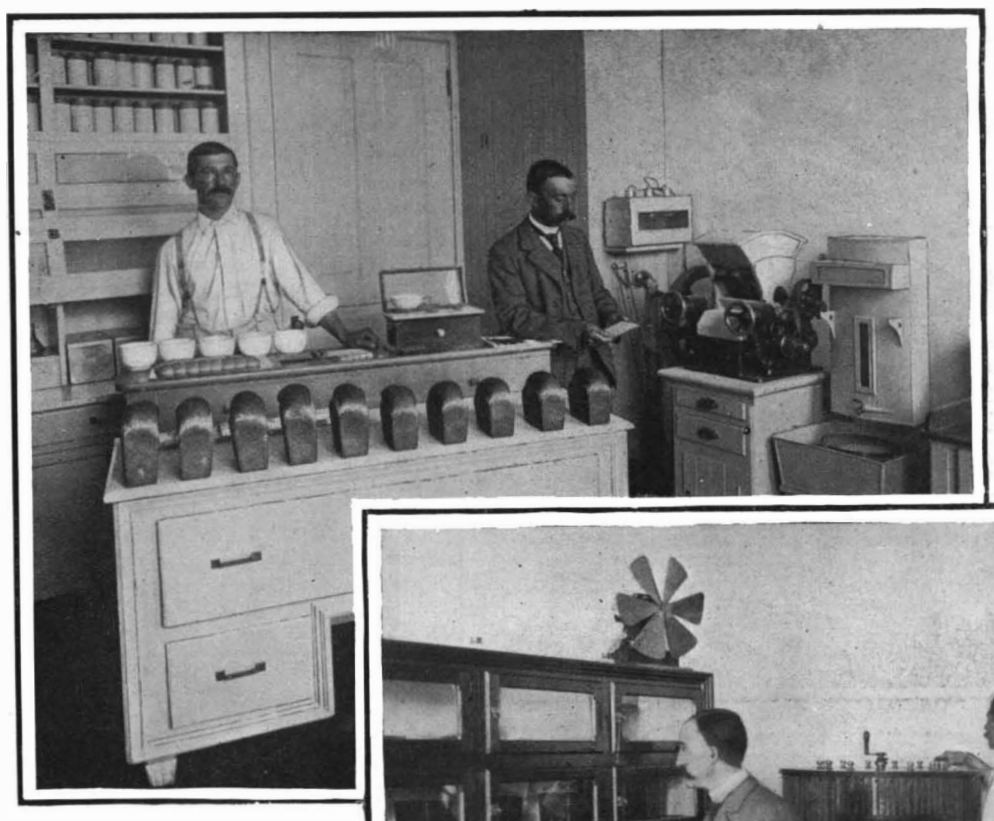
A CURIOUS BREAD SCHOOL.

BY KATHERINE LOUISE SMITH.

Little does the average housewife, who makes her bread by old and approved ways, dream that there is held every day of the year a school for bread inspection and that it is largely due to the "school" that her bread baked in her own oven is so good. In the "Flour City" of Minneapolis are the largest flour mills in the world, and here all day long and all night long is ground flour that is shipped to China, India, and all parts of the world. It is here that the "bread school" is held, and a most interesting day can be spent in attending this same school and watching the bakers and millers.

Every barrel or sack of flour that is sent out is tested, not once but many times, and the "bread school" is part of the test. So minutely are the records of these experiments kept that if a letter came from Bombay saying that a carload of flour was found defective on its arrival, it is possible by looking over the register and tracing its course from its entrance as grain to the finished product, to know what condition the flour was in when it left and whether it was injured in shipment from dampness or other causes. Think of keeping track of nine million barrels of flour! And yet this is the output of one company alone a year. Every large mill has a kitchen, and in this takes place the final test to which the flour is subjected. Before it reaches this kitchen the wheat has been through many processes and experiments, but it is the kitchen trial that stands as the ultimate criterion.

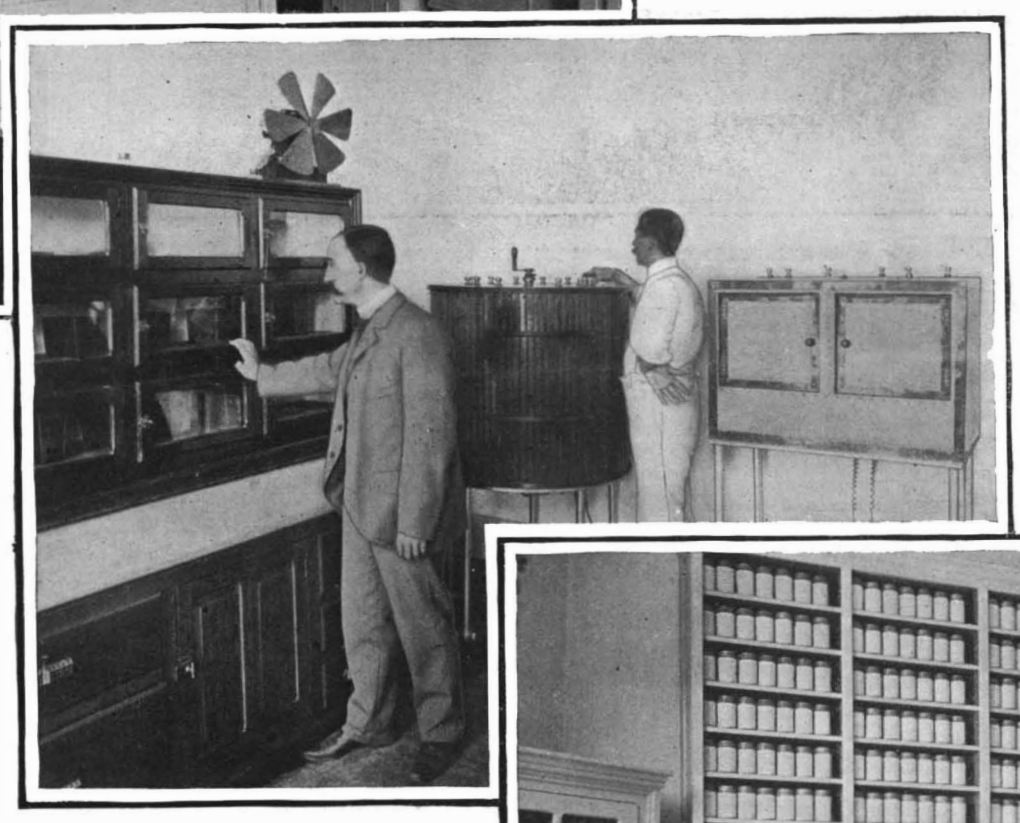


Fresh Bread From the Ovens, Ready to be Tested.

When the hard spring wheat of the Red River Valley of the North, which contains more phosphates and gluten than any other wheat in the world, is ripe, it is shipped to numerous small country elevators in Minnesota and the Dakotas, where it is stored temporarily, ready to be sent to the big grinding mills. Sometimes this wheat is grown by small farmers, but more often it is the product of very large ranches. Here acres and acres of wheat as far as the eye can reach are nodding in the wind, so that it looks like a sea of grain before it is cut. When it is gathered it is dumped into elevators owned by these ranchmen. Short railroads run to the elevators.

When the wheat reaches the mills it is side-tracked and the cars are unloaded by means of huge automatic grain shovels. Inside of the mills the grain is at once submitted to a rigid gluten test to disclose its strength and the best is made into flour. The latest method for making flour is the reduction method; that is, the wheat is granulated instead of pulverized. One hundred and fifty separations are made from the time the wheat is received until it is ready for shipment, and as all this work is done by machinery, with clocklike precision, the rapidity with which flour is turned out is wonderful. To begin with, the wheat is sent to the roller mills, where it gets the first crush. From here it is carried to a sieve where the middlings or grits are separated. This is done with rollers, which are pressed together six times, each time closer than before, so that the middlings become very fine. The finest result of this sixfold crushing is put through purifiers, where all imperfections are removed by suction and sifting. Dust and dirt are caught in a dust collector made of flannel tubes, and the middlings are then ready to be ground into flour.

Not the least marvelous part of this preparation is the machinery with which the work is done. Automatic carriers elevate and transport the grain in all directions, and the visitor is lost in amazement at the precision and ingenuity. Even the exact amount of flour which is finally dropped into barrels or bags is ascertained by machinery, so that no more and no less than the desired quantity falls down the spout into the receiving receptacle. This receiving receptacle, whether bag or barrel, is usually marked to indicate the brand of the flour. Every one has seen the mark XXX and XXXX and wondered what it means, but this is simply the mark which indicates the excellence of the flour. At certain stages during its preparation the middlings are sent to the mill's chemist to be tested, and before it reaches its last resting place ready for shipment it is the chief object of interest in the kitchen. This kitchen is a series of well lighted and ventilated rooms. The walls are of spotless white, the pans shining, the ovens are electric and of the most approved pattern with glass doors, thermometers, and every other convenience for baking bread in the latest and best way. The housewife would be delighted with these kitchens. All day the chemist and bakers work in these rooms. First they make the gluten test, where the half-ground wheat is mixed with water into little pats that look exactly like the children's mud pies. These pats are allowed to stand on glass for a certain length of time, and their consistency at the end of that time determines the grade of the wheat. A record is taken of this by the chemist in his big book, and the carload of wheat of which this is a sample is kept track of during all its processes. This makes it possible to turn to the many hundred bottles on the chemist's shelves and to find the sample and see exactly how it ranks by chemical analysis. The report of the gluten and other tests made during the grinding of the wheat is sent back to the head miller who is handling it, and he in this way knows what quality he is dealing with.

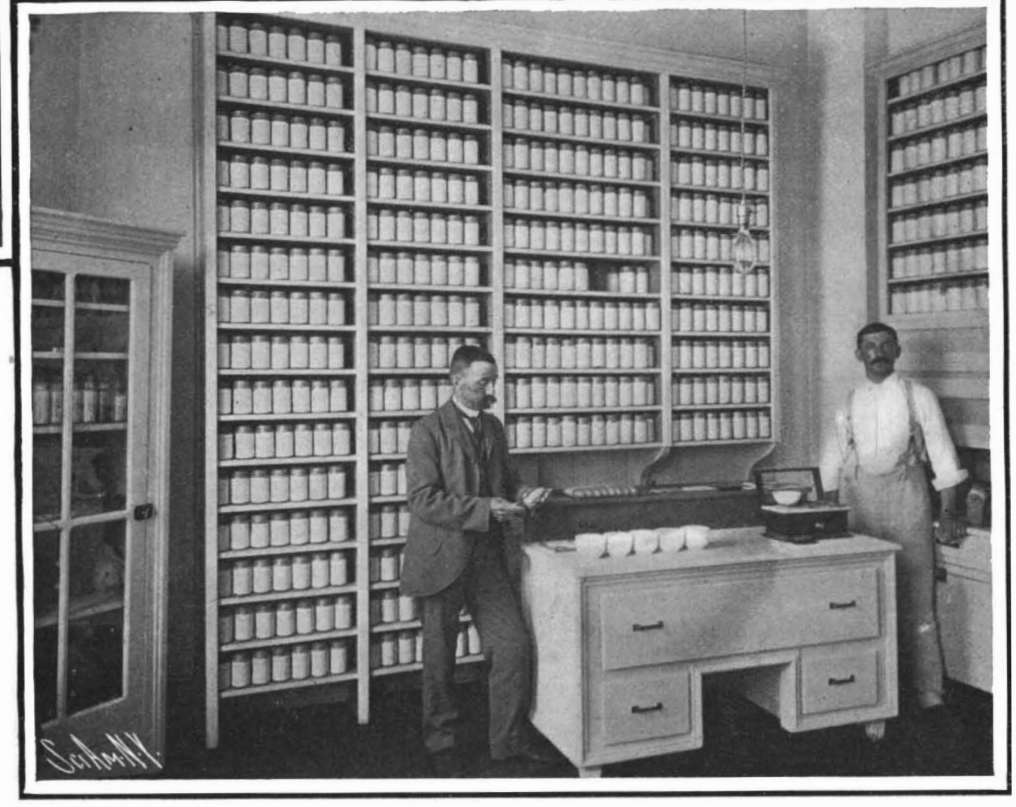


Baking Bread in Electric Ovens.

Of course every day a certain number of barrels of finished flour is turned out. The largest mill in the world turns out 15,000 a day, and some companies run several mills. Think what a tremendous undertaking it is to keep track of the quality of that amount of flour! Yet this is done. Every morning, before nine, the head millers send to the kitchen samples of the finished flour which they have waiting for barrels. After the flour is marked so that the chemist knows which miller sent it and it is compared with the tests which he has made during its preparation, the cook, in white apron and cap, begins to mix his bread. He makes his own yeast that he may be sure of the quality, and he has many small jars. Enough flour for one loaf of bread is put in each jar and care is taken not to mix the flour, as in this case there could be no test.

After the bread is mixed, one loaf in each jar, and as many jars as there are brands of flour, it is allowed to rise and is finally baked in the electric oven. An immense row of these ovens stretches across one side of the room, one above the other. Great care is taken in the baking, and electricity is used in preference to other heat that the temperature of the oven may be the same all over. In ovens heated by other methods the bottom is hotter than the sides or top. When the bread is finally done it is placed on a long wooden table to cool. Every loaf is the same size and shape, for the same amount of flour was used in each, and they look alike, but the wily chemist has kept track of them in his book and knows exactly what flour was used in each and what mill it came from.

At four in the afternoon the bread is cool and the chemist proceeds to cut each loaf in two, using a tape line so that the measurements will be correct. Then he sends for the head millers. In they file, and stand in solemn silence around the half loaves of bread until the chemist asks them to inspect it. Every half loaf is taken by the millers, held in the hand to weigh it, punched to see how flexible it is, taken to the window to examine the grain, and the pores are carefully noted. Then each miller tells which he thinks is the best loaf and the loaves are graded accordingly. No man knows which loaf was made from the flour sent from his mill. The chemist compares his notes with the decision of the millers and thus knows exactly how these particular shipments ought to be branded. The final test is this by the millers. It cannot but be impartial, and is the best means of telling how the flour ranks. Altogether the school of bread inspection is the most interesting of any of the proceedings in the large mills, and hours could be spent watching the process of making a barrel of flour.



The Chemist Testing Samples of Grist or Middlings for Gluten.

A CURIOUS BREAD SCHOOL.

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RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

FASTENING DEVICE.—C. E. CASHMORE, New York, N. Y. The object of the invention is to provide a device which will not become accidentally uncoupled in use, but which may be readily separated and connected when desired even when placed in awkward positions, as for example, at the back of the neck, at which place a fastening for a necklace is ordinarily located.

Electrical Devices.

LIGHTNING-ARRESTER.—C. I. STOCKING, Hiawatha, Kan. The aim in this improvement is to provide an arrester, which is simple, durable, compact and rigid in construction, dust and moisture proof, and arranged to insure safe passage of an arc from a line to the ground without danger of setting fire to surrounding inflammable material.

CLAMP-INSULATOR.—G. POLLOCK and W. E. WERD, Deer Lodge, Mont. The more particular object in this invention is the provision of a type of insulator made in halves and adapted to exert leverage upon a wire so as to grasp it tightly in position as well as to insulate it thoroughly from surrounding parts, and also to protect it within certain limits from the effects of moisture.

WIRE-SUPPORT. — L. STEINBERGER, New York, N. Y. The more particular object of this inventor is to provide a construction in which the positioning of the clip or ear for holding the wire is rendered independent of the tightening of the clip; that is to say, the ear or clip is first disposed properly in a position which it is to occupy, and is then secured without being rotated.

ELECTROMAGNETIC APPARATUS. — J. MCINTYRE, Jersey City, N. J. In the present patent the invention has reference to induction coils and similar apparatus, and the object is the provision of a new and improved electromagnetic apparatus, arranged to permit convenient and accurate adjustment of the make-and-break contact points.

Of Interest to Farmers.

PLANTER.—J. T. GANTT, Macon, Ga. The present invention is an improvement upon the cotton planter for which Mr. Gantt formerly received Letters Patent of the U. S. The improvements are embodied chiefly in the construction of the castings or brackets attached to the frame, whereby he has greatly increased the strength and durability of the connections and correspondingly reduced cost of manufacture.

CHAIN-HARROW.—J. DATSON, Gilberts Creek, Ky. The inventor seeks to provide a harrow composed of links which may be alike and are linked together longitudinally and laterally forming longitudinal and lateral rows, and in which the alternate links of the rows are connected by cross links with the opposite links of the adjacent rows so that these alternate links are held approximately in a horizontal plane so that the links connecting the alternate links will be caused to operate vertically, and thus form runners to cut open the soil and clods to properly prepare the same in the use of the invention.

CENTRIFUGAL LIQUID-SEPARATOR.—F. H. REID, Sioux City, Iowa. This invention is an improvement upon that for which Mr. Reid formerly made application for Letters Patent. Milk and cream are separated effectively or completely by the present improved construction and arrangement of parts constituting the separator proper. and by the improved arrangement of a dividing plate, the inventor distributes the cream walls or surfaces so that they are comparatively short and therefore the cream is delivered from the separator bowl more rapidly and has greater density.

Of General Interest.

ADJUSTABLE FORM FOR CURVED SURFACES.—J. E. WOOD, Pittsburg, Pa. A purpose of the invention is to provide a form for curved surfaces, for use in the construction of masonry and concrete bridges, culverts, tunnels, sewers, and in places where it is necessary to use a supporting form during construction work. The construction can be easily removed from the finished work, dismantled and transported.

WATER-TRAP FOR CORNETS, ETC.—J. H. VIOL, Deer Lodge, Mont. In brass wind instruments of the trumpet style it frequently happens, especially in long solos, that it is not preferable to blow out the accumulated water without an awkward break in the music. To overcome this difficulty, the inventor arranges a small water trap in the line of the wind passages, adapted to take up the accumulated water without interfering with the passages or affecting the quality of the notes.

REEL.—E. G. MCINTYRE, Butte, Mont. The object in this case is to provide a reel for twine or rope, and arranged to hold the ball of twine or the coil of rope securely in position, to insure convenient and quick unreeling whenever it is desired, and without danger of the rope or twine becoming entangled.

UMBRELLA-FIXTURE.—W. C. L. MASKA, New York, N. Y. One purpose of the improvement is to provide a readily applied substitute for the eye ends of umbrella ribs and stretchers when such parts become broken, which attachment or fixture will enable a damaged stretcher to be pivotally attached to the ribs, or a damaged rib pivotally connected with the crown in practically as secure a manner as if the stretcher or rib were intact.

PROCESS OF PRODUCING POTASSIUM COMPOUNDS.—R. H. MCKEE, Lake Forest, Ill. The invention refers to the separation of potassium compounds from earthy materials, and more particularly from potash bearing materials containing mica in the forms in which these substances are found in nature. It further relates to the production from the above substances of a soluble potassium salt of use as a manure and for manufacturing purposes.

CAN-CLOSURE.—J. A. FLEMING, Paola, Kan. The object of the inventor is to provide a construction which can be easily operated for the purpose of separating a lid from a can body so that after the can has served its original purpose as a carrier for oil or the like, it can be utilized as an ordinary bucket, the lid being adapted for application to the body and removal therefrom in the ordinary manner, after connection has been once severed.

WINDOW-CLEANER. — J. GROSSGEBAUER, Paterson, N. J. The purpose of this invention is to provide a device especially adapted for cleaning the vestibule windows of trolley or motor cars, or the windows of engine cabs or other vehicles from frost, rain, snow or hail, or excessive dust deposited thereon during a storm, which device is a fixture and operated from within by the motorman, or an engineer, thus enabling such persons to maintain a clear look-out in the face of a storm.

DISPLAY-STAND.—A. E. BROWN, Teeswater, Ontario, Canada. The object in this instance is to provide a stand, more especially designed for displaying wall coverings and accessories in stores or by canvassers, and in such manner that the customer receives the impression of the entire wall covering for a room, the arrangements being such to permit the dealer to quickly change the sample coverings and to permit of conveniently placing them in position on the stand or removing the coverings therefrom.

COMBINED LEVELING AND STADIA ROD.—J. H. ROBERTSON, Wily, Va. The object in this case is to improve graduations in such manner that distances and levels may be determined at both long and short range with celerity and certainty. This is done by a combination of colors, columns, and simple diagrams, the colors alternating with each other and dividing the rod transversely into several sections, each section representing the greater division of the rod. The diagrams are arranged in three columns with the length of the subdivisions of each column, in passing from a column of smaller to larger subdivisions, being a constant multiple of the next succeeding column.

LINE-DRIER.—P. V. ERICSON and L. G. ERICSON, New York, N. Y. The invention relates to improvements in devices for drying fish lines, an object being to provide a device of this character on which a line, drawn from a reel, may be wound in such a manner that the line will be exposed to a free circulation of air, and thus quickly and thoroughly dried.

DENTAL REGULATOR AND SPACER.—E. M. FLAGG, New York, N. Y. Certain improvements in apparatus for orthodontia, or correction of oral deformities are secured by this invention. By means of the device, which is cleanly, diminutive, and positive in action, teeth may be rotated in their sockets, shortened or lengthened therein, or moved forward or backward, and can be carried inward or outward toward their normal positions in the dental arch, or the entire arch expanded.

MOTIVE-AGENT GENERATOR.—J. L. TATE, Jersey City, N. J. The invention pertains to improvements in means for generating motive fluids adapted for use in the projection of motive power, or for use as a heating medium, and relates more particularly to means for generating steam by the heat of combustion and delivering the steam and the gaseous products of combustion through a simple conduit for employment for power or heating purposes.

CARPENTER'S SQUARE.—J. G. FEIL, New York, N. Y. Of several purposes of the invention, one is to provide a folding square so constructed that one limb can be carried at any desired angle to the other and be firmly held in adjusted position, and wherein the two limbs can be folded to lie closely edge to edge. A universal steel square is provided capable of being set to any bevel, miter, or for the cuts of body clips, files, and octagonal surfaces, or plumb and level cuts.

WAVE-MOTOR.—D. N. GREEN, Sunbury, Ohio. In operation the apparatus is to be rigidly anchored in any suitable manner on either a sand or rock shore, sufficiently far out into the water to secure the desired operation of the waves upon the float and when so anchored the float will be caused to rise and fall under wave influence, being balanced in a measure by a counterbalancing weight, directly applied to the beam and the latter arranged to directly operate the pump.

Hardware.

LOCK.—P. H. J. KRULDER and P. KRULDER, JR., New York, N. Y. This invention relates to sash and mortise locks operated by a key, and has for its object to provide means for closing the keyhole at the side of the lock opposite to that in which the key is used, thereby preventing the lock from being operated from the outside, and dispensing with the usual keyholes extending in line with each other, and the possibility of looking into a room through the holes.

CUTTING-TOOL.—J. CRYER, Walden, N. Y. The purpose of this improvement is to produce from a single piece of steel or other suitable metal, a tool having a peculiar, novel form that adapts the device for effective service as a boring tool, a taper reamer and a scraper; and that may be held for service in a handle along with a knife blade, or be mounted on a fixed handle.

UNIVERSAL WRENCH.—M. KORTH, Seattle, Wash. This wrench comprises an operating bar, a stub head provided with a socket, a universal joint between the bar and head, a pin movable transversely in the head, a spring secured at one end to the head having its opposite free end engaging the outer end of the pin, and a socket member detachably connected with the head and adapted to be engaged by the pin.

SADDLE HARNESS RING.—J. J. O'KANE, New York, N. Y. The improvements in this instance are in rings for attaching traces, thimble-straps, and the back band to a harness saddle. The object is to provide a ring so constructed that it may be rigidly attached to the saddle, thus obviating the constant swinging movement of the harness when in use, which quickly wears out the attached straps, and causes a rubbing wear on the saddle.

Heating and Lighting.

FILAMENT FOR INCANDESCENT LAMPS.—E. MCOUAT and H. W. F. LORENZ, Amsterdam, N. Y. The process of making incandescent filaments in this invention consists in dipping the carbonized core in a caramel solution containing finely divided metallic light-emitting particles in mechanical suspension whereby a coat is deposited on the core through which the particles are dispersed, and carbonizing the coat to render it and the particles integral with the core.

INCANDESCENT FILAMENT AND PROCESS.—E. MCOUAT, New York, N. Y., and H. W. F. LORENZ, Springfield, Ohio. In this improved filament and process the invention has reference to the manufacture of filaments or glowers such as used in incandescent electric lamps, and the object of the invention is to produce a filament having a high efficiency and a long period of usefulness.

CONDENSER.—O. A. NENNINGER, El Paso, Texas. This condenser may be used in combination with an ordinary house boiler, and comprises a jacket for the boiler. In operation steam from an ordinary tea kettle or other vessel on the range is admitted to the condenser, drawing therewith a supply of air to aerate the steam. Here it is partly condensed and then passes into the boiler jacket where condensation is completed.

LAMP-SHADE.—W. J. BOESEN, Orange, N. J. Mr. Boesen's invention has for its object to produce an ornamental and serviceable shade made partly of glass sectors so arranged as to exhibit cloth figures pasted inside of the glass and so connected as to obtain certain advantages in durability, convenience, and strength.

HEAT-TRANSFERRING APPARATUS.—V. CROIZAT, Turin, Italy. The apparatus consists of a series of plates provided with wide flanges and formed with openings at the center. These plates are arranged to be nested together and can be used as radiators for a variety of purposes, such as automobiles, etc., as heaters for baths, and in all cases where it is desired to transmit heat from gases to liquids, or vice versa.

Household Utilities.

SANITARY APPARATUS.—G. A. LUCAS, 65 Rue Vallier, Levallois-Perret (Seine), France. The object of this inventor is to produce an apparatus intended for destroying all fecal matters, and liquid house refuse by automatically effecting their transformation into a colorless, inodorous and inoffensive liquid. It can be placed in position either along or across the cesspool on the right hand or on the left and without special construction for each apparatus.

AUTOMATIC EGG-BOILER.—C. B. MARTIN, Portland, Oregon. In a certain type of egg boiler the eggs are held submerged by the buoyancy of a hollow vessel in which the water slowly enters. When this vessel is filled to a predetermined point, the eggs are automatically lifted out of the water. The present invention provides means for regulating the inflow of water into the vessel.

WASHBOARD.—G. C. HAYSLER, Clinton, Mo. Mr. Haysler invented a washboard which may be readily pressed out of sheet metal. The construction is very simple and economical and it provides for adjusting the body portion of the washboard upon the legs, as may be desired. The rubbing surface projects forwardly and provides at the upper end a receptacle for soap, and the like.

WELL-DOOR FOR DUMB-WAITERS.—A. E. FISCHER, New York, N. Y. The object of the inventor is to provide useful improvements in well doors for the elevator shaft, whereby the entrance opening to the shaft on one floor is closed when the entrance opening to the shaft on another floor is opened and vice versa, thus preventing draft in the shaft and thereby reducing the spread of flames by way of the shaft in case of fire in the building.

COFFEE POT AND STEEPER.—C. HOFFMAN, Detroit, Mich. The object in this invention is to make improvements whereby coffee or tea may be boiled and then steeped, to improved degree, the vessel being adapted for use therewith, of a common coffee or tea cup, the latter when arranged in place serving as a cover to the vessel, and adapted to permit effective steeping of the tea or coffee, and then drawing, or permitting flow of the infusion, direct into the cup from the boiling and infusing vessel.

Machines and Mechanical Devices.

MECHANICAL MOVEMENT. — W. A. WRIGHT, Greeley, Neb. The invention is particularly useful in connection with washing machines, churns and the like, in which an alternating rotary movement of certain parts is necessary. The object is to provide a movement for driving from a manually operated jointed frame having a flexible connection with a driven spindle.

CLEARING-WING FOR DITCHING-MACHINES.—W. UMSTEAD, Jerseytown, Pa. The purpose here is to provide a wing particularly adapted for the ditching machine for which a patent was formerly granted to Mr. Umstead. The wing is readily applicable to almost every type of a ditching machine, is very simple and economic in construction, and automatic in its action.

FLYING-MACHINE.—J. D. PURSELL, Chattanooga, Tenn. The intention in this case is to produce an aeroplane machine having efficient balancing means to maintain its equilibrium, and having improved devices for controlling, at all times, the center of gravity of the weight carried by the machine, and for controlling, also, the action of the air currents upon the aeroplane.

ATTACHMENT FOR ROLLING-MILLS.—F. MILLIKEN, New York, N. Y. The invention has reference to improvements in attachments for rolling mills, being especially directed to improvements in the conveyer table therefor. This table may be either fixed or pivotally mounted, the latter being ordinarily known as a tilting table, which is used in connection with rolls more than two high.

WIRE-WORKING MACHINE.—W. H. MERKEL, Columbus, Ga. The invention is intended especially to be used for forming the short wires or bars which are used in brick-making machinery for cutting the clay into unbaked brick. The object is to produce a machine quickly operated to form an eye at each end of a short length of wire. The construction is such as to enable the length of the wire to be readily adjusted as desired.

HEMP-BRAKE.—F. T. MARTIN, Winchester, Ky. The invention pertains to a machine designed for separating the fiber from the stalks and pulpy parts of hemp and the like, and has for its object to provide a machine, the main or special features of which are a bed provided with ribs on which the hemp is laid, and a pair of ribbed rollers which travel back and forth on the material, to break and separate the same.

PULP-SHAPING MACHINE.—A. KOMP, New York, N. Y. The invention contemplates a machine preferably altogether automatic in character and of large capacity, for molding articles of papier mâché or other indurated fiber, more especially such articles, for example, as plates, pails, basins, boxes, tubs, and other vessels.

SAFETY SET-SCREW.—C. E. HOFFMAN, Thomaston, Conn. The object of the invention is to provide a new and improved safety set screw for securely fastening machine parts in place, such as collars and pulleys on shafts and the like, the set screw leaving no projection and allowing convenient removal whenever it is desired.

BOOM AND ROTATABLE CIRCLE FOR EXCAVATORS.—J. P. KARR and J. D. RAUCH, Logansport, Ind. In this patent the improvement is in booms and rotatable circles of land and marine excavators, such as steam-shovels, dredges, and the like. The objects sought and attained by the improved construction, arrangement, and combination of parts are maximum strength, rigidity, lightness, and durability.

ADDING-MACHINE.—B. HOSKINS, Seattle, Wash. This machine is such as used in banks and similar institutions for adding itemized amounts. The object of the invention is to produce a machine which will operate to add the different amounts in a simple manner and which will enable the items added to be printed, together with the totals or aggregate amounts. In operation the machine is substantially automatic.

AUTOMATIC WEIGHING-MACHINE.—J. H. MCLEOD, La Salle, Ill. This machine is adapted particularly for weighing grain and is of that class in which the grain is received into a stationary hopper or bucket connected with a graduated weighing beam so as to tilt the latter when duly filled, whereupon the valve or gate closing the mouth of the weighing hopper is automatically opened to allow discharge of the contents. The present invention is an improvement on two former inventions for which patents were granted to Mr. McLeod.

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CENTRIFUGAL SEPARATOR.—R. F. CORDERO, Rubio-Tachira, Venezuela. This centrifugal separator is particularly adapted for separating moisture from coffee beans, although it may be employed for separating other matter. The machine is of very simple construction and enables the separation to be rapidly and thoroughly effected.

ATTACHMENT FOR TALKING-MACHINES.—A. DEE P. WEAVER and J. E. CARNEY, Montgomery, Ala. The invention provides means for placing a cartridge of sponge rubber in the horn of a talking machine and compressing the rubber, or expanding it according to the degree of porosity which the operator desires to confer upon it. By adjusting the sponge rubber the resonance of the air column can be regulated.

MAGNETIC SEPARATOR.—J. B. MCCABE, Buffalo, N. Y. In this separator a drum is provided which is rendered magnetic both within and without by means of a series of electromagnets. The magnetic drum is inclosed in a large cylinder and crushed ore is admitted both to the drum and the cylinder. When these are revolved the iron ore clings to the magnetic drum and is removed by brushes which sweep the material into a pair of conveyors.

SLICING-MACHINE.—E. A. SEABURG, Seattle, Washington. The machine provides means for slicing bread but may be used with equally good results for slicing vegetables. An effective draw-cutting action is continuously imparted to the knife while the machine is in operation so that the feed of the material to the knife will be automatic and capable of adjustment to cut a thick, a medium, or a thin slice.

TAPE-APPLYING MACHINE.—I. DREYFUSS, New York, N. Y. The purpose of the invention is to provide a machine especially adapted for inserting tape into paper boxes, which tape may be employed for holding the contents of the boxes in place. The tape is drawn from a reel, gripped by a needle and carried down thereby through the box after which the tape is automatically cut the desired length.

PNEUMATIC TOOL.—E. M. TOBIN, Barre, Vt. This pneumatic tool is so constructed that when the valve is open the full air pressure is admitted to the cylinder above the plunger through a straight and direct passage, thus avoiding the loss due to friction which occurs when air is compelled to flow through long passages having many turns and bends.

MACHINE FOR SEPARATING FIBERS FROM THE PULP AND OTHER EXTRANEOUS MATTER OF PLANTS AND TREES.—E. BEHRENDT, Manila, Philippine Islands. The invention relates to machines such as shown and described in Mr. Behrendt's former application for Letters Patent of the United States. The object of the present invention is to provide useful improvements in the machine whereby a single draw head only is required for a continuous operation of the machine, the construction and operation of the draw head and its carrier being exceedingly simplified.

MACHINE FOR SEPARATING FIBERS FROM THE PULP AND EXTRANEOUS MATTER OF PLANTS AND TREES.—E. BEHRENDT, Manila, Philippine Islands. This invention relates to brakes employed for separating fibers from the pulp or extraneous matter of the bark or leaf sheaths of the tropical abaca and other plants and trees, especially such as the abaca yielding manila hemp, to be made into rope or cordage, the present machine being an improvement on the machine shown and described in Mr. Behrendt's former application for Letters Patent of the United States, for hemp stripping and cleaning machines.

MACHINE FOR SEPARATING FIBERS FROM THE PULP OF PLANTS AND TREES.—E. BEHRENDT, Manila, Philippine Islands. This improvement refers to breaks employed for separating fibers from the pulp of the bark or leaf sheaf of the tropical abaca (Musa textilis) and other plants and trees, especially such as the abaca, which yields manila hemp. The object of the inventor is to provide a machine for separating the fibers in an economic manner and without danger of injury to the fiber.

GAS-ENGINE-REVERSING SWITCH.—E. P. DU PONT, Montchanin, Del. Means are provided in this invention for reversing the direction of revolution of a gas-engine, employing an electric spark device. Inasmuch as the explosion of gas must take place in definite relation to the position which the crank occupies in its revolution around the shaft, any circuit controller which times the spark to this relation of the crank must in any reversing mechanism be correspondingly changed to time the spark in the new direction of revolution.

COMBINED PIANOFORTE AND AUTOMATICALLY-ACTUATED MECHANISM THEREFOR.—J. BRINSMEAD, Grafton road, Kentish town, London, England. The invention relates to pianofortes adapted to be played manually or mechanically by means of mechanism which leaves the keyboard entirely exposed to view, and has for its principal object to enable the automatic mechanism to operate upon the hammer action without the movement being transmitted through or to the keys or key levers, so that the latter are undisturbed when the piano is being mechanically played, and the consequently useless wear and tear of key levers and associated parts are avoided.

PUMP-DRAIN.—G. G. FORESTER, Bagley, Iowa. When the pump is working means are provided to move the drainage opening out of register with the opening in the casing and to permit the seating of the check valve. When it stops means are provided whereby to permit the drainage of the water from the discharge pipe and pump and the parts connected therewith. The improvement is entirely automatic in its action, not depending upon any factor except the starting and the stopping of the pump.

Prime Movers and Their Accessories.

ROTARY ENGINE.—P. MACA. MACKASKIE, Goldfield, Nevada. The invention pertains to improvements in engines or motors of the rotary type, the object being to provide an engine, primarily adapted for the use of mixed gasoline and air as a motive agent, but which, by leaving off certain parts may be actuated by steam.

SAFETY DEVICE FOR INDICATORS.—I. L. KISER and O. M. PRINCE, St. Charles, Mo. In this instance the invention refers to certain improvements in means for preventing the escape of steam and water from a boiler in case the glass of the level indicator should become broken, and, at the same time, serving to indicate the fact that the glass is broken.

GOVERNOR.—H. F. AMMERMANN and W. LOHSE, New York, N. Y. The invention relates to steam engine governors, and the object is to produce a combination throttle and governor valve, the construction of the valve comprising a spring; and a further object is to provide improved means for regulating the tension of this spring.

MOTOR.—K. F. ERICKSEN, New York, N. Y. The invention relates particularly to internal combustion motors in which an explosive fuel operates on a turbine. A piston is used to draw in fuel and compress it in the well-known manner. Thereupon it is held stationary and forms an abutment for the impact of the discharge when the fuel is ignited. The fuel passes to a turbine after being somewhat expanded and acts upon the turbine blades after the usual manner.

IGNITER FOR INTERNAL-COMBUSTION ENGINES.—F. E. REAM, Green Ridge, Mo. The object of Mr. Ream's invention is to devise a reliable means for igniting the charge in an internal combustion engine. This end he attains by providing a metal tongue co-acting with a continuously-moving member, preferably of emery, or like abrasive material, the parts being arranged to engage each other at the ignition point in the cycle of the engine, so that a shower of sparks is produced in the compressed mixture of fuel and air and flame is propagated instantly.

PISTON-VALVE FOR INTERNAL-COMBUSTION ENGINES.—H. W. ADAMS, Fargo, N. D. The present invention is an improvement upon a previous application, and it has for its object to provide means whereby air or an explosive mixture may be admitted to the piston cylinder through the piston thereof, or whereby the exhaust gases may be removed through the piston to the outside atmosphere.

T-PIPE.—W. H. BELLMAINE, Pocatello, Idaho. The invention relates to a T-pipe or connection between the dry steam pipe and the delivery steam pipes of boilers. The underlying object of the invention is to provide a connection which shall be readily accessible and less subject to temperature extremes than heretofore, thus insuring an efficient connection without interfering with the usual repair and adjusting operations on the boiler.

WATER-CURRENT MOTOR.—H. W. SCHMIDT, New York, N. Y. Mr. Schmidt's invention has for its object to produce a motor of simple construction which will utilize the energy of water currents. A special object of the invention is to provide an arrangement which will enable the motor to have a wide range of usefulness in practice, and to provide such a construction as will enable the motor to be reversed so as to adapt it to tide movements.

Pertaining to Vehicles.

OILER.—J. W. LADD, Bristol, N. H. Mr. Ladd's invention relates to oilers, his more particular object being to produce a type of oiler comprising an oil receptacle capable of being inserted in a wagon-hub or other revoluble member, and so constructed as to discharge oil in small quantities at a predetermined rate as the member rotates.

AUTOMOBILE-TIRE.—G. G. SULLIVAN, Buffalo, N. Y. The invention provides simple means for strengthening the tires of automobiles, and increasing their wearing qualities. The outer shoe is provided with a metallic shield of woven, or linked chain work which while flexible prevents expansion of the shoe and protects the inner tube against puncture or bursting.

ATTACHMENT FOR AUTOMOBILES.—H. J. CARR, Sumter, S. C. Mr. Carr's invention relates particularly to a device adapted for connection with the cranking shaft of an automobile whereby the engine of the automobile may co-operate with the drum and the cable thereon in pulling the machine out of mud or out of a hole or ditch.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

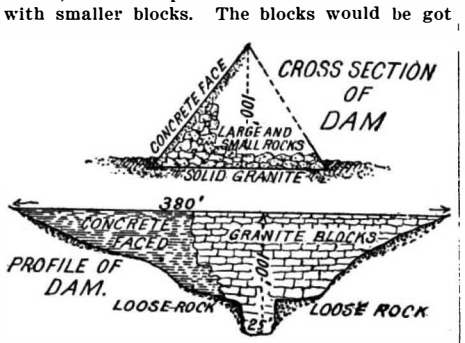
HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

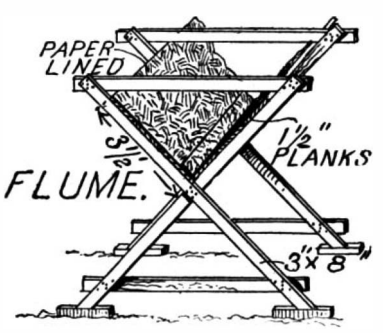
Our attention has been called to the statement made in a recent reply to a query that the Wehnelt interrupter was not patented. It seems that a patent is held upon this device by a well-known firm of makers of surgical instruments in New York, of which we were not informed at the time of our writing.

(10631) W. D. S. asks: I have something that I am unable to solve, and write you for information. If you like you may publish the discovery. However, I hold the right of discovering for myself and friends. I inclose you a common white feather, which you will hold close to one eye, and close the other eye. Hold your hand between you and the light about two feet from the feather, and you can see the bones as if looking through an X-ray. You can also see through solid substance, such as a silver dollar, etc. A. The interesting experiment you send us has been made a great many times. It is an effect of the interference of the waves of light when they pass the edges of narrow slits or openings, such as those between the barbs and barbules of a feather. A fine piece of cloth, such as bolting cloth or fine silk, will also show the same phenomenon. That you do not "see the bones, as if looking with an X-ray," will be evident, if you look at a rod of wood or iron through the feather. You will see a bone in the wood or iron, just as you do in the finger. This curious effect is produced by the bending of the rays of light as they come from the rod of wood or the finger, and then pass through the narrow spaces of the feather or cloth. After they are thus bent they cross each other, and seem to bring light to the eye from both edges of the wood or finger. There is therefore a border or margin on both sides of the finger or rod of wood, from which some light seems to come to the eye. The central dark strip is seen in its real illumination, less than the edges show, and this you call the bone.

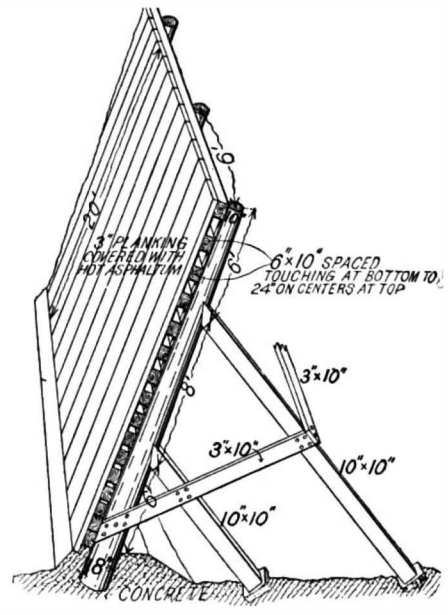
(10632) A. F. M. writes: 1. We have here some very favorable sites for storing water for power and irrigation, and desert lands and mines which would be benefited. Cement, however, is too expensive, having to be carried by pack animals across 80 miles of bad country. It is a country of granite, with abundant timber for constructing large cranes. We propose to hoist large granite blocks 4 to 5 feet cubic into the dam-site. These would not be dressed blocks, and the spaces between would be filled with smaller blocks. The blocks would be got



by blasting. The wall would be built 140 feet wide at the base, and about 100 feet in depth; the inner surface faced with cement and crushed granite 1 in 5 or 1 in 6. The same to be well cemented to the solid granite bottom and sides; and about 4 feet thick at the bottom and 9 inches at the top and somewhat set into the rock on the inner side. Would the

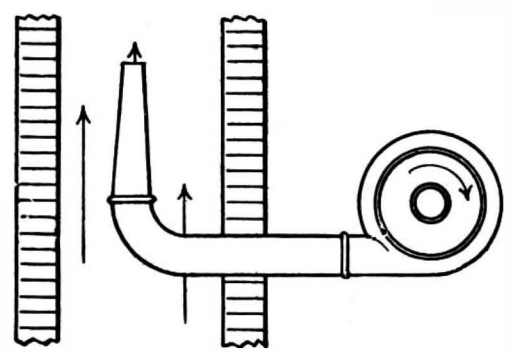


dam hold, or is there danger of the heavy loose rock settling sufficiently to crack the cement badly? Slight leakages would not matter. I inclose explanatory sketch. 2. We want to carry the water in a flume made from the coarse local pine. The temperature varies from freezing in winter to 100 deg. in summer; and heavy thunderstorms are followed by hot sun, which will cause the boards to warp and split. We propose to nail the boards tightly in place, and line them with asphalt paper to prevent leaking. The water will be free from foreign matter, which might wear the paper. 3. Would a dam stand, if constructed of a wooden wall lined on the inside with 8-ounce canvas well oiled with linseed oil and venetian red or other metallic paint? The dam not to be more than 20 or 30 feet high and its base to rest on low cement dams, well cemented to solid rock foundation, so that neither the wood nor its cloth covering comes in contact with the soil, but only with water or air. A. In



reply (1) we would consider that the dam you describe is practical and safe if the stone is well laid and bonded, and the spaces between the larger stones properly wedged with smaller ones so as to make the whole one solid mass of stone. We would advise concrete facing thicker than you suggest—about 6 feet thick at the bottom, and 2 feet at the top. A good water-tight joint must be made between the concrete and the foundation bedrock and care must be taken that the body of the dam rests properly on a bedrock foundation which has been cut in steps to receive it. (2) In regard to the flume we think the best plan for keeping same water-tight is to line it with burlap laid in hot pitch tar or asphaltum and again coated with the same material after it has been laid. Care should be taken to lap joints well. (3) Your timber dam is practical up to 20 feet or so. We give sketch of same with dimensions figured for safe loads up to 20 feet. To keep the planking water-tight coat with asphaltum, or with burlap and asphaltum put on as described for the flume in case the cracks between the planks are wide. If the water is always kept in storage the timber will not rot where it can always be kept wet. It is better to keep the air away from the bottom of the posts for that reason.

(10633) F. McC. writes that a recently installed steam-heating system does not work satisfactorily. He asks how the draft may be increased, and if a forced draft could be installed if necessary. A. You can determine whether insufficient draft is the cause of your heating boilers failing to give satisfaction by having the flue gases and ash residues analyzed, to show whether combustion is sufficiently complete. You can readily increase the draft artificially by inserting a blower at any point in the flue or chimney thus:



The blower being driven by a small electric motor or otherwise as convenient. The B. F. Sturtevant Company, 114 Liberty Street, New York, would give you full particulars. We are pleased to advise you, but are not the people who installed the heating plant responsible? You should be able to compel them to put the plant in such condition as to give satisfactory service without further cost to you.

(10634) U. J. W. asks: Will you kindly give me the necessary information to make a spark coil such as is usually used on motor cycles, the three terminals for three cells of dry batteries? A. You will find in SUPPLEMENT No. 1281, price 10 cents, an article giving the information you wish regarding the ignition of a gas engine. The data for a

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sparking coil are given in that article. A coil with a single winding is used, with an iron core. The self-induction of the discharge gives the hot spark for ignition.

(10635) H. M., Jr., says: In your issue of September 28, under the heading No. 10618, you publish a solution of the problem of making a concrete gasoline tank tight. Your idea is to saturate the dry walls and roof with melted paraffine. May I call your attention to the fact that paraffine is extremely soluble in gasoline, and that while this treatment might serve excellently to make the tank retain water, it would be worse than useless in the case of gasoline. From my experience with concrete, I should think a coating of cement plaster—1 part cement to 1 part sand—applied thoroughly to the bottom and sides of the tank, would materially help to tighten it. This plaster should be not less than ¼ inch thick at any spot. In case this failed a coating of hot tar might be applied throughout, provided the parts to which it is applied are thoroughly dry. The tar should be very hot, and most carefully applied. Dampness in the walls will make it peel. When one considers how difficult it is to make a simple concrete structure even water-tight, the problem of retaining so volatile a substance as gasoline in concrete offers difficulties that make one skeptical of its success. And it is certainly against reason to suppose that such can be achieved through the use of any substance soluble in gasoline.

(10636) F. A. McD. asks for formulas for plate and film developers, using the following active substances: (1) Pyrogallic acid, (2) hydroquinone, (3) eikonogen, (4) metol.

1.—

Pyro Solution.

Distilled or pure ice water.	6 ounces
Oxalic acid	10 grains
Sodium sulphite (crystals).	1 drachm
Pyrogallic acid	1 ounce

Alkali Solution.

Water	64 ounces
Sodium carbonate (crystals)	2½ ounces
Sodium sulphite (crystals)	3 ounces

To prepare the developer, add 2½ drachms of the pyro solution to 8 ounces of the alkali solution. In case of warm weather or over-exposure, add 10 to 40 minims of a bromide of potash solution made up of 1 ounce of potassium dissolved in 10 ounces of water.

2.—

Hydroquinone	2 grains
Sodium sulphite (crystals)	60 grains
Water	1 ounce

Alkaline Solution.

Sodium carbonate	60 grains
Water	1 ounce

To one ounce of the alkaline solution add two ounces of the hydroquinone solution and one ounce of water. If the density is insufficient increase the hydroquinone.

3.—

No. 1.

Water	40 ounces
Sodium sulphite	2 ounces
Eikonogen	1 ounce

Alkali Solution (No. 2).

Water	3 ounces
Potassium carbonate	1 ounce

Take 2 ounces of No. 1 and from 1 to 2 drachms of No. 2. Add more of No. 2 if development proceeds too slowly.

4.—

No. 1.

Metol	½ ounce
Water	32 ounces

Dissolve the metol in 16 ounces of water, then in the second 16 ounces dissolve 5 ounces of sodium sulphite (crystals); add the two solutions, which forms the stock solution.

No. 2.

Water	32 ounces
Potassium carbonate	2½ ounces

No. 3.

Bromide of potassium solution, 20 grains dissolved in 32 ounces of water.

For average exposure take 2 ounces of No. 1, ½ ounce of No. 2, and add 3 ounces of water. If development proceeds too fast add ½ drachm of No. 3 solution. For under-exposure add more of No. 2. If ¼ ounce of hydroquinone is added to the No. 1 metol solution a developer of considerable power is compounded.

Ortol Developer.—A vigorous developer giving a brownish deposit; keeps well in two solutions.

No. 1.

Water	10 ounces
Meta bisulphite of potassium.	40 grains
Ortol	80 grains

No. 2.

Water	10 ounces
Sodium sulphite (crystals)	1 ounce
Potassium carbonate	160 grains

For correct exposures add 1 ounce of No. 1 to 1 ounce of No. 2 and 1 ounce of water. If the exposure is unknown add 1/10 part of No. 2 to No. 1 and 1 ounce of water, then add a little of No. 2 at a time until development proceeds moderately.

Pyro Acetone Developer.—Acetone is substituted for the usual alkali. The following is used by Lumière Brothers:

Water	100 parts
Sodium sulphite (anhydrous)	5 parts
Acetone solution	10 parts
Pyrogallic acid	1 part

NEW BOOKS, ETC.

ARTILLERY AND EXPLOSIVES. Essays and Lectures Written and Delivered at Various Times. By Sir Andrew Noble, Bart., K.C.B., D.Sc. (Oxon.), D.C.L., F.R.S., etc. New York: E. P. Dutton & Company, 1907. 8vo.; pp. 548. Price, $6.

Although this work is a compilation of various notable essays and lectures delivered by the author, the fact that they are arranged in chronological order, and that each represents the progress in artillery and explosives at the date the papers were given, makes the work thoroughly connected and complete, with nothing of the fragmentary character which might at first be supposed. Sir Andrew Noble's reputation as one of the first authorities in the world on the subjects dealt with, would alone give great value to the work; but judged strictly on its own merits, the present volume is one of the most lucid, complete, and truly interesting works on the subject that has appeared for many years. It opens with a paper read before the Royal Artillery Institution in 1858 on the "Application of the Theory of Probabilities to Artillery Practice," and closes with a paper on "Methods That Have Been Adopted for Measuring Pressures in the Bores of Guns," read before the British Association in 1894. Hence the book covers the most progressive period in the development of artillery; in fact, it may be said to embrace the whole of the time during which the modern high-velocity rifle gun has been brought to its present excellence. The particular value of the book arises from the fact that it embodies the results of valuable experimental work carried out largely by the distinguished author himself. Furthermore, these experiments were favored by the fact that ample means were at command for work which is necessarily of an intricate and costly character. Notable chapters are those on "Tension of Fired Gunpowder"; "Researches on Explosives"; "Heat Action of Explosives"; "The Energy Absorbed by Friction in the Bores of Rifle Guns"; and "Pressures Developed by Some New Explosives." The work is freely illustrated with diagrams and woodcuts, and is enriched with elaborate tables. At the close of the book are a set of full-page drawings, showing the turret and other mountings of heavy ordnance on ships of the British navy.

THE SANITARY EVOLUTION OF LONDON. By Henry Jephson, L.C.C. Brooklyn: The A. Wessels Company. 8vo.; cloth; 440 pages. Price, $1.80 net.

The story of the modernization of London reads like a romance. Sixty years ago London was a medieval city, in a sanitary condition scarce conceivable to a modern mind. The elements of decency and sanitation were neglected—almost unknown. The sewers were open ditches draining directly into the Thames, whose polluted tidal waters swinging slowly back and forth every twelve hours provided the drinking water of a large part of the population. The rich drained into cesspools beneath their houses; in the poor districts drainage and sanitation were unknown. Water supply was doubtful in quality, intermittent in supply, and not laid into the houses. Thousands of families lived in single rooms—hundreds of single rooms harbored two or more families—and infectious disease was chronic in many houses.

Attempts to improve conditions have been steadily fought by vested interests. Concession after concession has been wrung from Parliament, placing powers in the hands of the people, and responsibilities on the shoulders of property owners. When the party of progress found the opposition too strong for them, they merely waited until an extra wave of cholera or smallpox raised public indignation and gave them the support they needed. Finally, in 1888 the London County Council was formed. For the first time a central body took hold of the work of government, for until then innumerable small bodies had ruled and wrangled, each supreme in one tiny corner of London. With the creation of the County Council, ratepayers for the first time were able to elect their own representatives and to hold them to an accounting.

The author is a member of the London County Council, and like so many members of that unsalaried organization, has thrown himself whole-heartedly into the task of thoroughly mastering the subjects he is called on to handle. He marshals his facts lucidly and concisely, and has given us a book which cannot be overlooked by anyone interested in the problem of city government.

MATHEMATICAL GEOGRAPHY. By Willis E. Johnson. New York: American Book Company. 12mo.; cloth; 336 pages, illustrated. Price, $1.10.

Even descriptive geography is extremely fascinating, for it possesses an intimate personal element. When we go to the study of the relations of our earth to the rest of the universe, the personal element still remains, but there is added a feeling of grandeur. The books treating of the astronomical relations of the earth with reference to their practical usefulness have not been satisfactory in the past. They were either too puerile or too deep; too limited or too scattered; so that the casual investigator was not attracted to the consideration of these most useful questions. "Mathematical Geography," by Mr. Johnson, meets the needs of the interested layman by treating of the mechanical phenomena exhibited by our globe. The computation of time, latitude, and longitude are all clearly taken up and carefully explained. The principals of map-making, and the various kinds of projections—Mercator's, homolographic, and conic—are fully gone into, as are the rotation and revolution of the earth and the "nutation" of the poles. In the appendix are instructions for the construction and adjustment of sun-dials. The entire work is interesting as well as practical.

INDUSTRIAL ALCOHOL. The Production and Use of Alcohol for Industrial Purposes and for Use as an Illuminant and as a Source of Motive Power. By John Geddes McIntosh. With 75 illustrations and 25 tables. London: Scott, Greenwood & Co. New York: D. Van Nostrand Company. 8vo.; cloth; 252 pages. Price, $3.

When our Denatured Alcohol Bill was under discussion, it seemed that an unlimited field of wealth was about to be opened to all of us. To become enormously wealthy, all one had to do was to set up a still, and convert into alcohol the disagreeable refuse that the garbage man formerly carted away. However, when the distilling of alcohol was shown by those conversant with the subject to entail too great an initial outlay for the individual to profitably carry it on, the subject was dropped, and now we hear nothing more about it. In spite of this quite usual treatment, our law has made possible an industry that in other countries has proved to be full of profit to those who intelligently carry it on. The knowledge necessary to operate such a plant is not too technical to be beyond the reach of any intelligent man with some scientific aptitude, nor is the capital needed for its installation excessive. Like every business, however, such operations must be begun and managed with intelligence. A number of books on the subject have been written in foreign tongues, but in English a much smaller number. Among the best of these may be mentioned those by J. R. Brachvogel and J. G. McIntosh, respectively. Mr. Brachvogel's work is larger and more complete than any of the others that have appeared. Mr. McIntosh's book is less comprehensive, but seems to be very complete and to cover about as much ground as is necessary. He treats of the properties of alcohol, the various ways of distilling, and the different materials used in its production, such as beets, grain, potatoes, and so on. In ending he discusses the alcohol derivatives and the use of alcohol for lighting purposes.

HANDBOOK OF AMERICAN GAS ENGINEERING PRACTICE. By M. Nisbet-Latta. New York: D. Van Nostrand Company. 8vo.; cloth; 466 pages. Price, $4.50 net.

The author intends this to be the first of a series of handbooks on gas engineering, which when complete will cover every branch of the industry. He goes at length into the manufacture of water gas, and the distribution of gas; and 200 pages are devoted to general technical data. The book is written for the practical man, and should prove of use to those employed in gas works. Methods of manufacture of gas other than water gas will be described in subsequent volumes, but the parts of this book dealing with distribution and general data are applicable to all fields of gas engineering.

THE STOKER'S CATECHISM. By W. J. Connor. New York: Spon & Chamberlain. 16mo.; paper; 63 pages. Price, 50 cents.

The man about to become a stoker is under the disadvantage of being unable to find any textbooks on the subject. If he is unable to find some veteran who is sufficiently kindly to instruct a novice, he must gain his knowledge by experience at the risk of being discharged by his employer. The "Stoker's Catechism" has a number of questions and answers intended to prevent the more important of the mistakes that beginners are apt to make. Mr. Connor the author, is in error when he places the value of the horse-power at 32,000 foot-pounds per minute. This slight oversight, however, does not in any way detract from the usefulness of what should prove to be an excellent guide to its subject.

DRAHTLOSE TELEPHONIE. Ernest Ruhmer. Berlin: The author, 1907. paper; 6¾ x 11 inches; 142 pages, 139 figures. Price, $1.

A fully-illustrated and complete description of the progress of wireless telephony.

MODEL STEAM ENGINE DESIGN. By R. M. de Vignier. New York: Spon & Chamberlain. Paper; 95 pages; illustrated with diagrams. Price, 25 cents.

A little handbook containing practical information and calculations of use to model engineers.

METRIC WEIGHTS WITH ENGLISH EQUIVALENTS. By Hugh P. McCartney. New York: Spon & Chamberlain, 1907. Red leather; 3½ x 4 inches, 88 pages. Price, 50 cents.

A convenient set of tables showing the values of the metric weights from 1 gramme to 50,000 kilogrammes in the English and troy systems. The calculations are based on the gramme-value of 15.432 grains.

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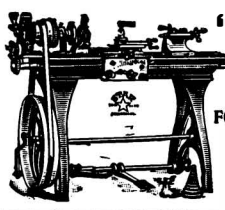

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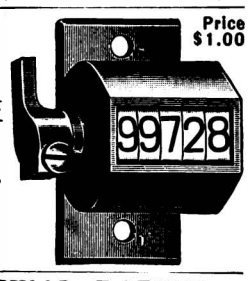

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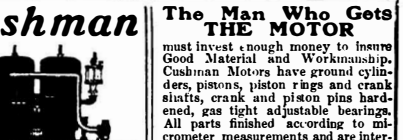

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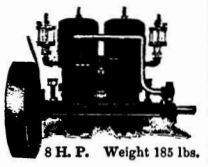

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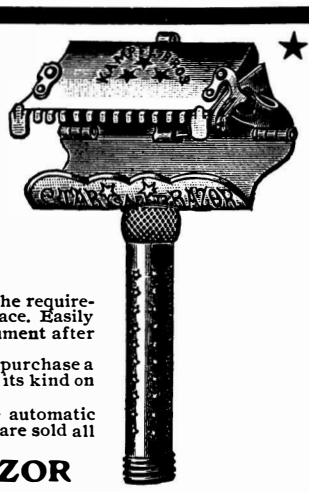

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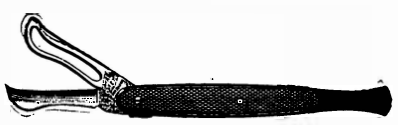

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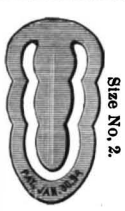

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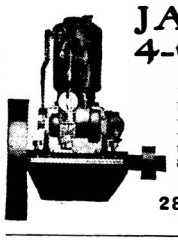

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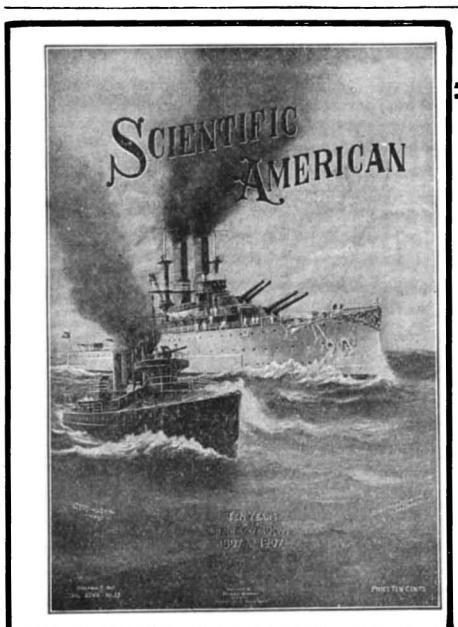

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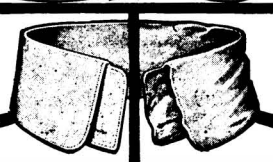

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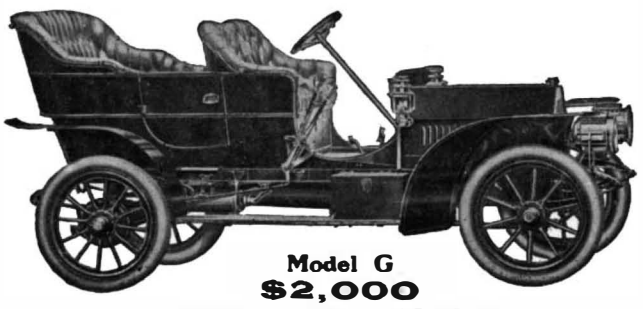

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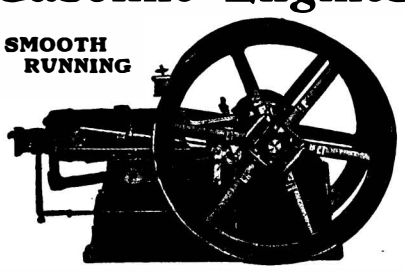

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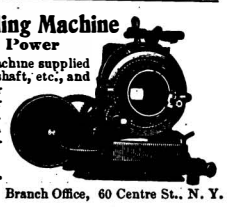

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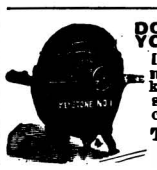

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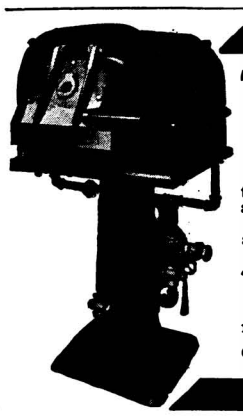

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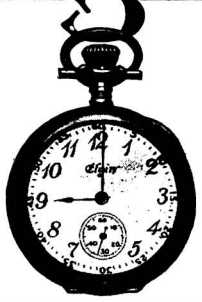

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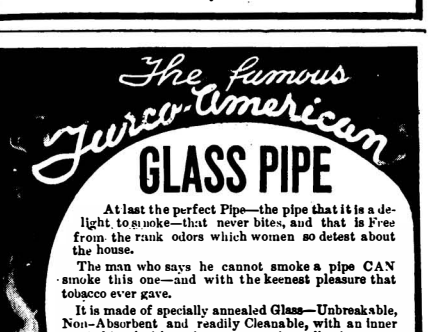

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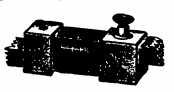

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